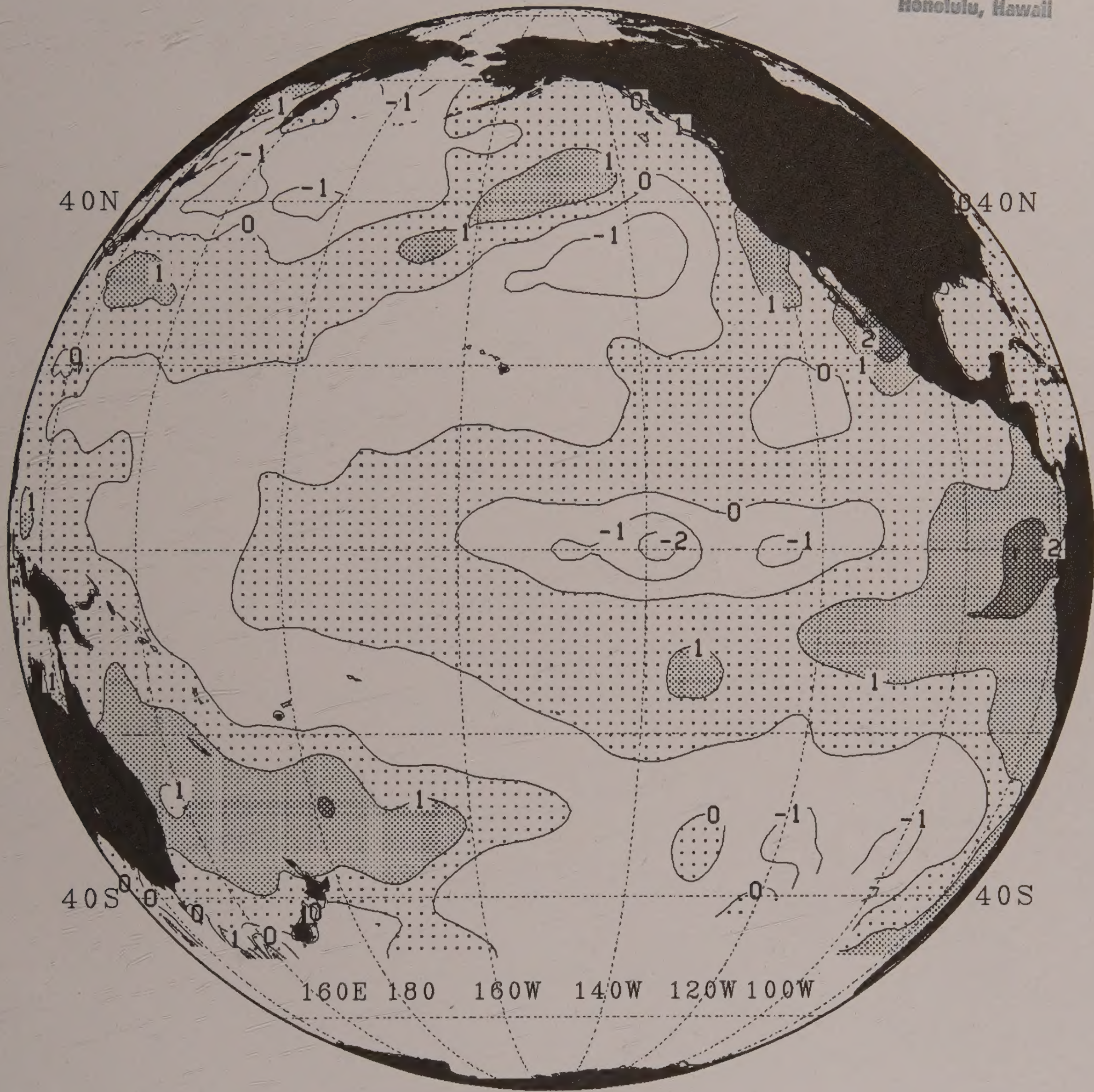
気象庁海洋月報

Monthly Ocean Report

June 1998 (No. 66)



Climate and Marine Department
Japan Meteorological Agency

気象庁 気候・海洋気象部

平成10年6月

気象庁海洋月報は、気象庁 気候・海洋気象部 海洋課で作成しています。

本月報に関する問い合わせは、

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Monthly Ocean Report is prepared by the Oceanographical Division, Climate and Marine Department, Japan Meteorological Agency.

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表紙は、1998年6月の太平洋の月平均海面水温偏差図です。

陰影部は、平年より高温の海域を示しています。

The figure on the front cover shows the monthly mean SST anomalies for June 1998 in the Pacific Ocean.

Areas of positive anomalies are shaded.

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海況の特徴（１９９８年６月）

日本近海の海況

海面水温は，東海沖，本州の南東及び北海道の北で平年より１℃以上高く，北海道の南から三陸沖にかけて平年より１℃以上低かった（第4図）。

黒潮は，上旬から中旬は九州から四国にかけて，下旬には紀伊半島まで接岸していた。５月下旬に紀伊水道沖に見られた小蛇行は東に移動し，６月下旬には東海沖に達した。関東近海から東では，三宅島付近を経た後，房総半島沖を東に流れ，35°N，144°E付近から南に蛇行していた（第9図）。

親潮系の冷水の沿岸寄りの分枝は38.0°N,142.7°Eまで,沖合の分枝は37.0°N，145.5°Eまで，それぞれ達していた（第5図）。

太平洋の海況

太平洋赤道域東部の海面水温正偏差域は縮小し，110°W以東に限られた。160°Wから110°Wにかけては負偏差となり，150°Wから135°W，及び125°W付近では平年より１℃以上低かった。昨年3月から正の値が続いていたエルニーニョ監視海域（4°N～4°S，150°W～90°W）の海面水温偏差は急速に減少し，0.0℃となった（表1）。

北太平洋では，日付変更線以西の30°N付近に沿って+0.5℃以上の正偏差域が見られ，135°Eから160°Eでは平年より1℃以上高かった。40°Nに沿っては-1℃以下の負偏差域が見られた。一方，日付変更線以東では，45°N，140°Wから南西方向に+1℃以上の正偏差域が広がり，その南では-1℃以下の負偏差域が見られた（第16図）。

Highlights June 1998

Seas adjacent to Japan

Positive SST anomalies exceeding +1°C were found off Tokai, southeast of Honshu and north of Hokkaido. SSTs were more than 1°C below normal south of Hokkaido and off Sanriku (Fig. 4).

The Kuroshio flowed along the coasts from Kyushu to Shikoku in the first and second 10-days, and flowed along the coasts from Kyushu to Kii Peninsula in the last 10-day. The small meander of the Kuroshio, which was found off the Kii Channel in the end of May, moved eastward and was found off Tokai in the last 10-day of June. East of 139°E, after passing near Miyake Island, the Kuroshio flowed eastward off Boso Peninsula, then turned southward at 35°N, 144°E (Fig. 9).

Coastal and off-coastal branches of the Oyashio cold water extended southward to 38.0°N, 142.7°E and 37.0°N, 145.5°E, respectively (Fig. 5).

Pacific Ocean

In the equatorial Pacific, the positive SST anomalies in the eastern part were confined to east of 110°W. Negative SST anomalies were found from 160°W to 110°W, and those exceeding -1℃ were found from 150°W to 135°W and around 125°W. The SST anomaly of the El Niño monitoring region (4°N-4°S, 150°W-90°W), which had kept positive value since March 1997, has remarkably decreased to 0.0℃ in June 1998 (Table 1).

In the western North Pacific, positive SST anomalies exceeding +0.5°C were found along 30°N, and those exceeding +1℃ were found from 135°E to 160°E. Negative SST anomalies exceeding -1℃ were found along 40°N. In the eastern North Pacific, A region of positive SST anomalies exceeding +1℃ stretched SE-ward from 45°N, 140°W. South of the region, negative SST anomalies exceeding -1℃ prevailed (Fig. 16).

東シナ海のブイロボットにおける二酸化炭素の観測
Observation of carbon dioxide on a buoy in the East China Sea

気象庁は，洋上大気中及び表面海水中の二酸化炭素濃度を無人で連続観測する装置を新たに開発した．この装置を東シナ海の気象庁海洋気象ブイロボットに試験的に搭載し，1997 年 6 月 30 日から 1998 年 1 月 6 日にかけて観測を行った．1997 年 7 月～9 月における 3 時間毎の二酸化炭素濃度及び風速の観測結果を図 A に示す．

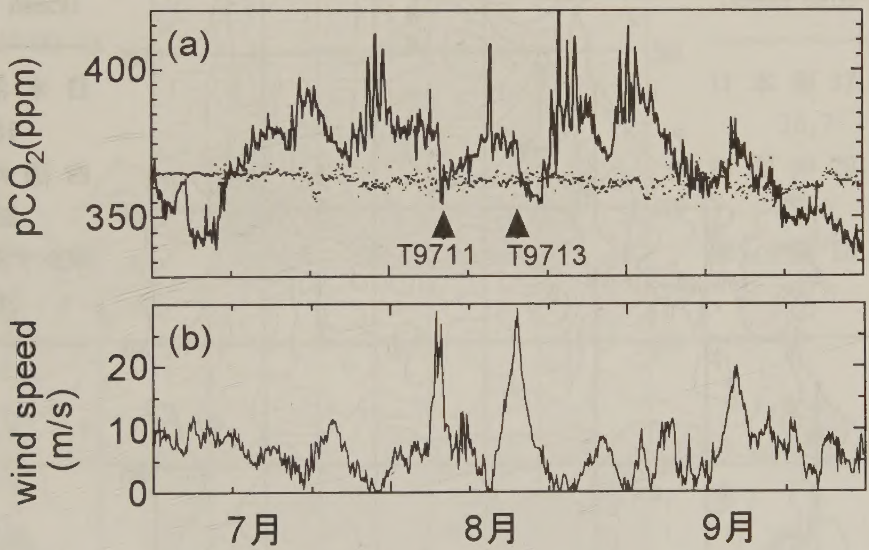
観測期間中，大気中の二酸化炭素濃度は 370～380ppm でほぼ一定であったのに対して，海水中の二酸化炭素濃度は 320～440ppm と大きく変化した．夏季には海水中の濃度が大気中よりも高くなり，当海域は二酸化炭素の放出域となった．また，短期間の現象として，台風がブイに接近して風速が増大するとともに急激に海水中の濃度が減少したこと，風速が小さい期間には海面水温の日変化に追随した海水中の濃度の日変化が大きいことが観測された．

こうした長期連続観測により海水中二酸化炭素濃度の様々な時間スケールの変動をとらえることが可能となり，その観測結果は今後海洋における炭素循環の解明に大きく寄与することが期待される．

The JMA developed a new automatic measuring system for the concentrations of atmospheric and oceanic carbon dioxide (CO_2). The system had been mounted on the JMA buoy in the East China Sea, and had observed CO_2 from 30 June 1997 through 6 January 1998. Time series of CO_2 concentrations and winds every three hours from July to September in 1997 are shown in Fig.A.

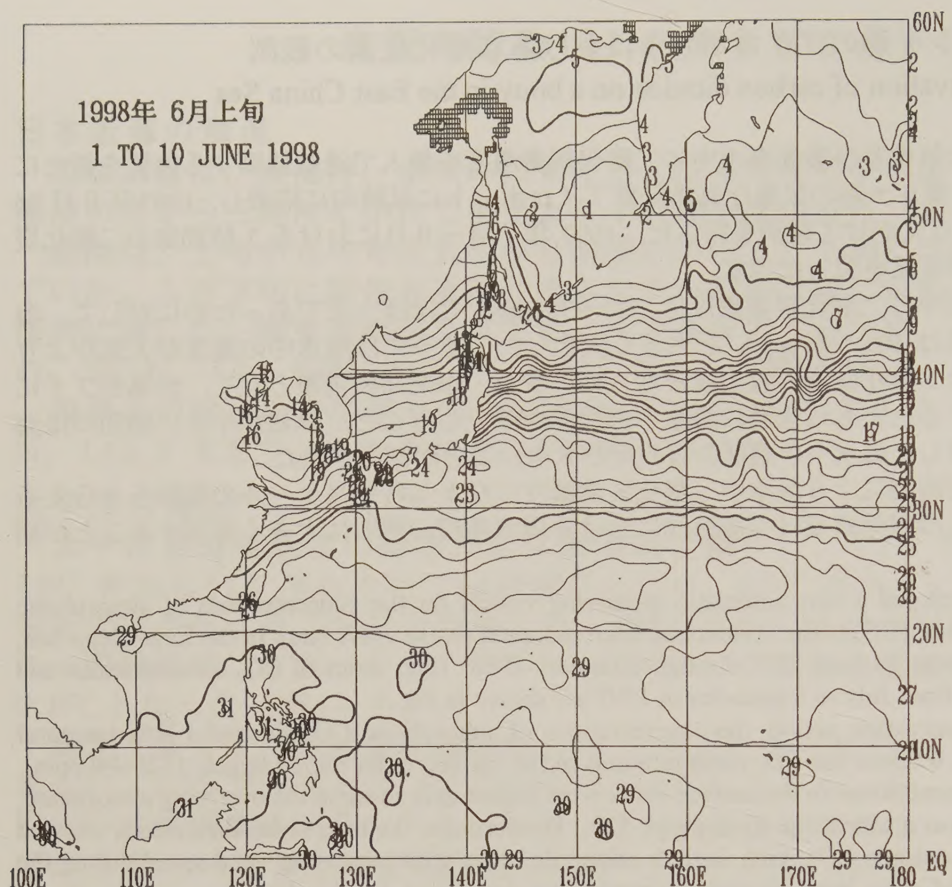
During the observation period, the concentrations of atmospheric CO_2 showed a little temporal variation (370-380ppm), whereas the CO_2 concentrations in the surface water varied largely (320-440ppm). In summer, the CO_2 concentrations in the surface water were higher than those in the overlying atmosphere, implying that this area was a source for atmospheric CO_2. Furthermore, the time series data clearly showed short-term variations of oceanic CO_2, such as their abrupt decrease with increasing wind speed during the passage of typhoons, and their large diurnal variations that are driven by the diurnal variations of sea surface temperature under calm conditions.

The data obtained by the system will contribute to understanding of the various time scale variations of oceanic CO_2 and, consequently, elucidating a carbon cycle in the ocean.



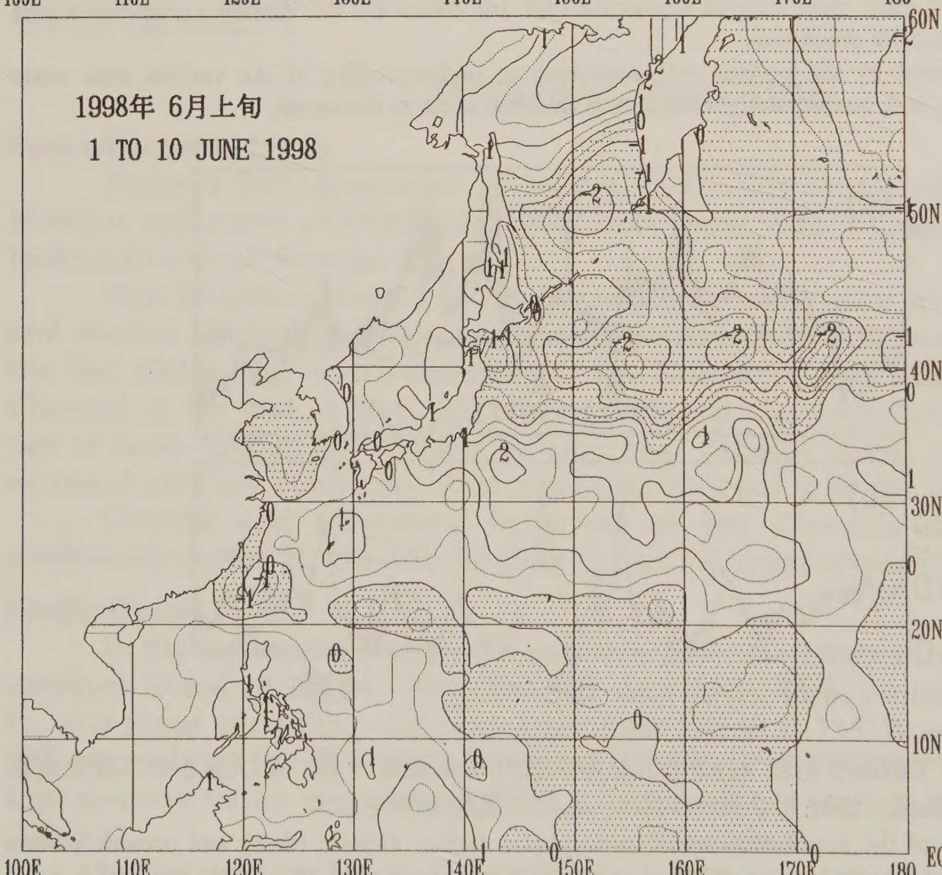
図A　東シナ海ブイで観測された (a)洋上大気中二酸化炭素濃度（点）及び海水中二酸化炭素濃度（実線）と (b)風速（1997 年 7 月～9 月）．▲は台風接近時を示す．

Fig.A (a) Time series of the concentrations of atmospheric carbon dioxide (dots) and oceanic carbon dioxide (solid line), and (b) wind speed observed at the JMA buoy located at 28° 10'N, 126° 20'E in the East China Sea from July to September in 1997. Closed triangles show the time when typhoons (T9711 and T9713) passed close by the buoy.



旬平均沿岸水温(℃)
Coastal Water Temperature

地点名 (Index Number)	水温 Temp.	偏差 Anom.
石　垣(47918)	27.0	0.1
御前崎(47655)	22.0	1.2
八丈島(47678)	23.0	0.9
小名浜(47598)	13.7	-0.7
宮　古(47585)	12.6	1.2
江　差(47428)	15.1	-
浜　田(47755)	20.2	-



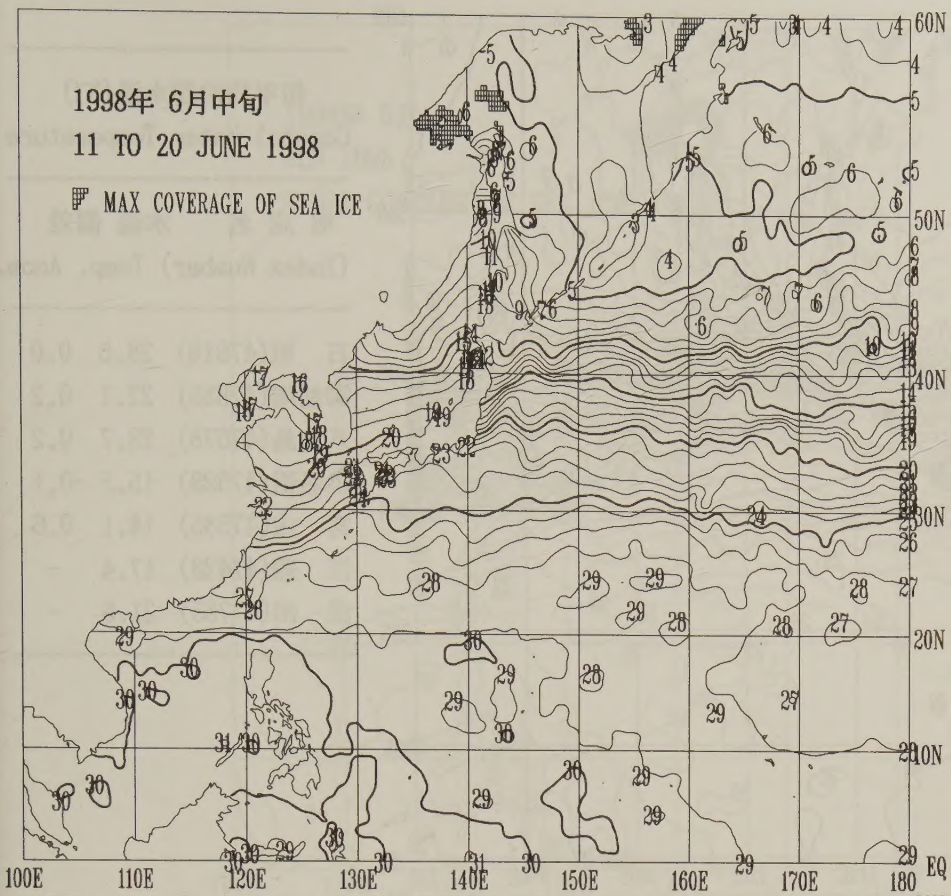
海洋気象ブイロボット
旬平均海面水温(℃)
Ocean Data Buoy SST

地点	位置	SST
日本海	37.9N,134.5E	18.4
四国沖	29.0N,135.0E	25.5
東シナ海	28.2N,126.3E	26.5

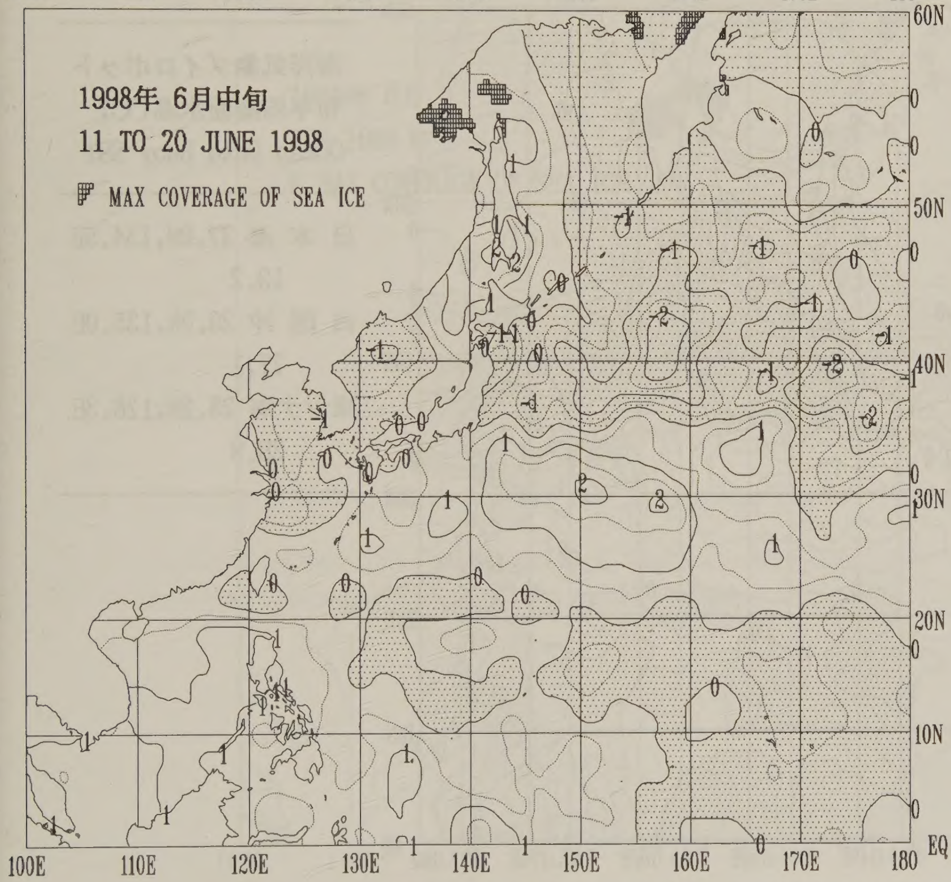
第1図 北西太平洋旬平均海面水温図(上)及び偏差図(下)(1998年 6月上旬)

Fig.1 Ten-day mean SST (top) and anomalies (bottom) in the western North Pacific for the 1st ten-day period in JUN 1998. Anomalies are computed from the JMA climatology (1961-90). Contour interval is 1°C and additional anomaly contours of 0.5°C are shown by broken lines. Negative anomalies are spotted.

Ten-day mean SST & Anomalies



旬平均沿岸水温(℃) Coastal Water Temperature		
地 点 名 (Index Number)	水温 Temp.	偏差 Anom.
石 垣(47918)	27.5	-0.2
御前崎(47655)	22.0	0.6
八丈島(47678)	23.1	0.3
小名浜(47598)	14.9	0.4
宮 古(47585)	12.9	0.5
江 差(47428)	16.3	-
浜 田(47755)	20.8	-

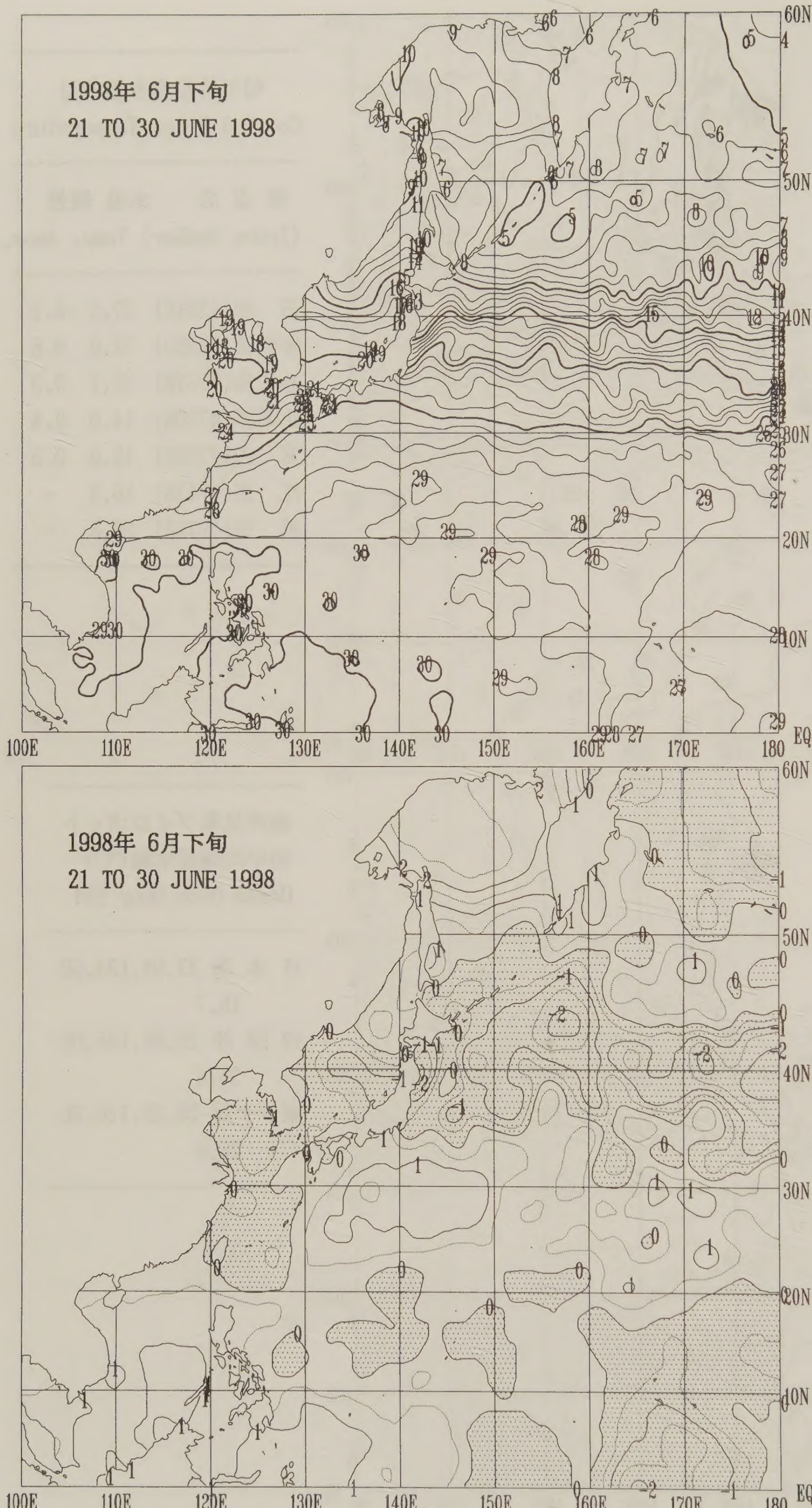


海洋気象ブイロボット
旬平均海面水温(℃)
Ocean Data Buoy SST

日 本 海	37.9N,134.5E	18.7
四 国 沖	29.0N,135.0E	25.6
東シナ海	28.2N,126.3E	25.6

第2図 北西太平洋旬平均海面水温図(上)及び偏差図(下)(1998年 6月中旬)

Fig.2 Ten-day mean SST (top) and anomalies (bottom) in the western North Pacific for the 2nd ten-day period in JUN 1998. Anomalies are computed from the JMA climatology (1961-90). Contour interval is 1°C and additional anomaly contours of 0.5°C are shown by broken lines. Negative anomalies are spotted.



旬平均沿岸水温(℃)
Coastal Water Temperature

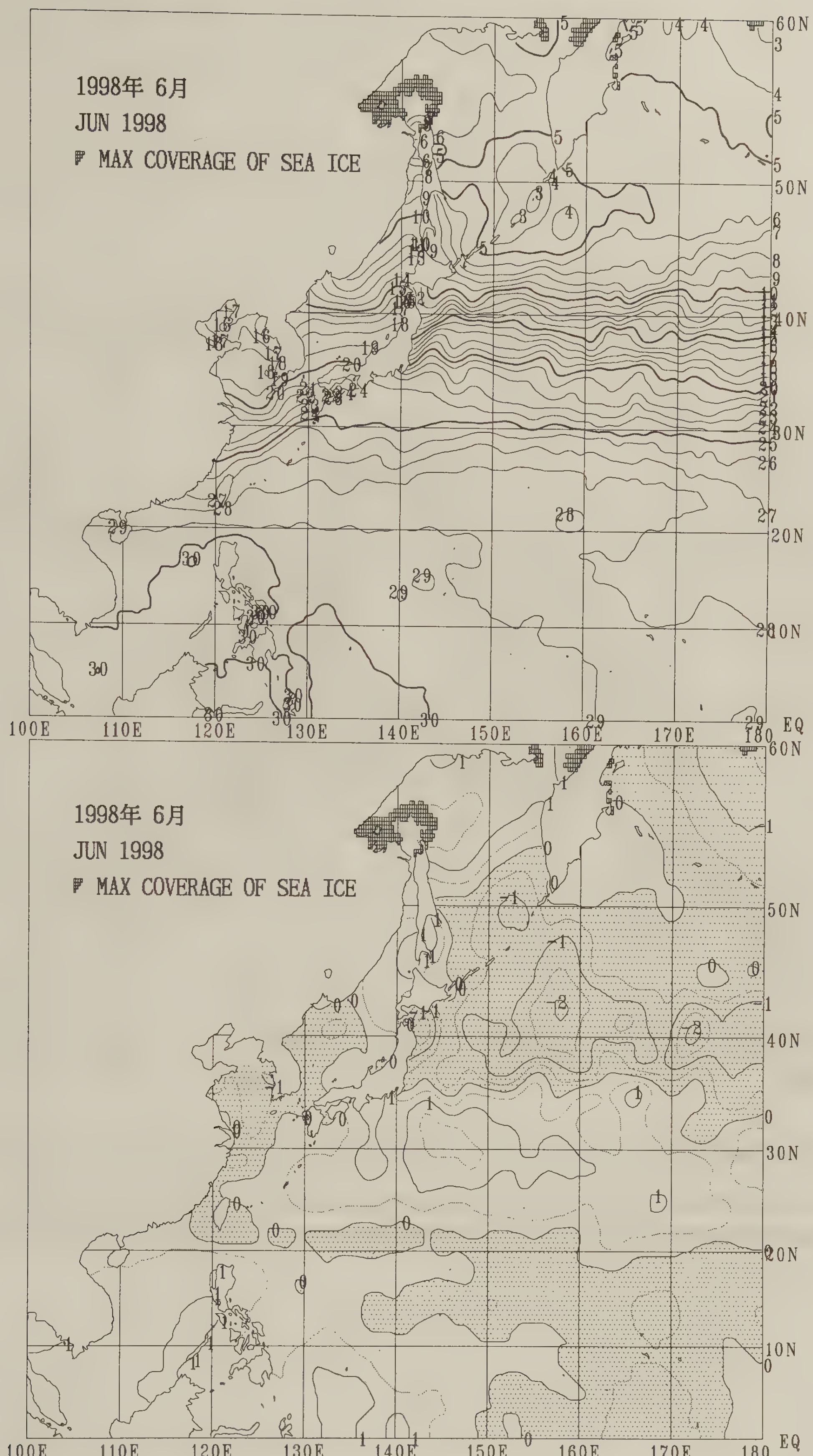
地 点 名 (Index Number)	水温 Temp.	偏差 Anom.
石　垣(47918)	28.5	0.0
御前崎(47655)	22.1	0.2
八丈島(47678)	23.7	0.2
小名浜(47598)	15.5	-0.1
宮　古(47585)	14.1	0.6
江　差(47428)	17.4	-
浜　田(47755)	21.5	-

海洋気象ブイロボット
旬平均海面水温(℃)
Ocean Data Buoy SST

日 本 海	37.9N,134.5E	19.2
四 国 沖	29.0N,135.0E	27.1
東シナ海	28.2N,126.3E	26.9

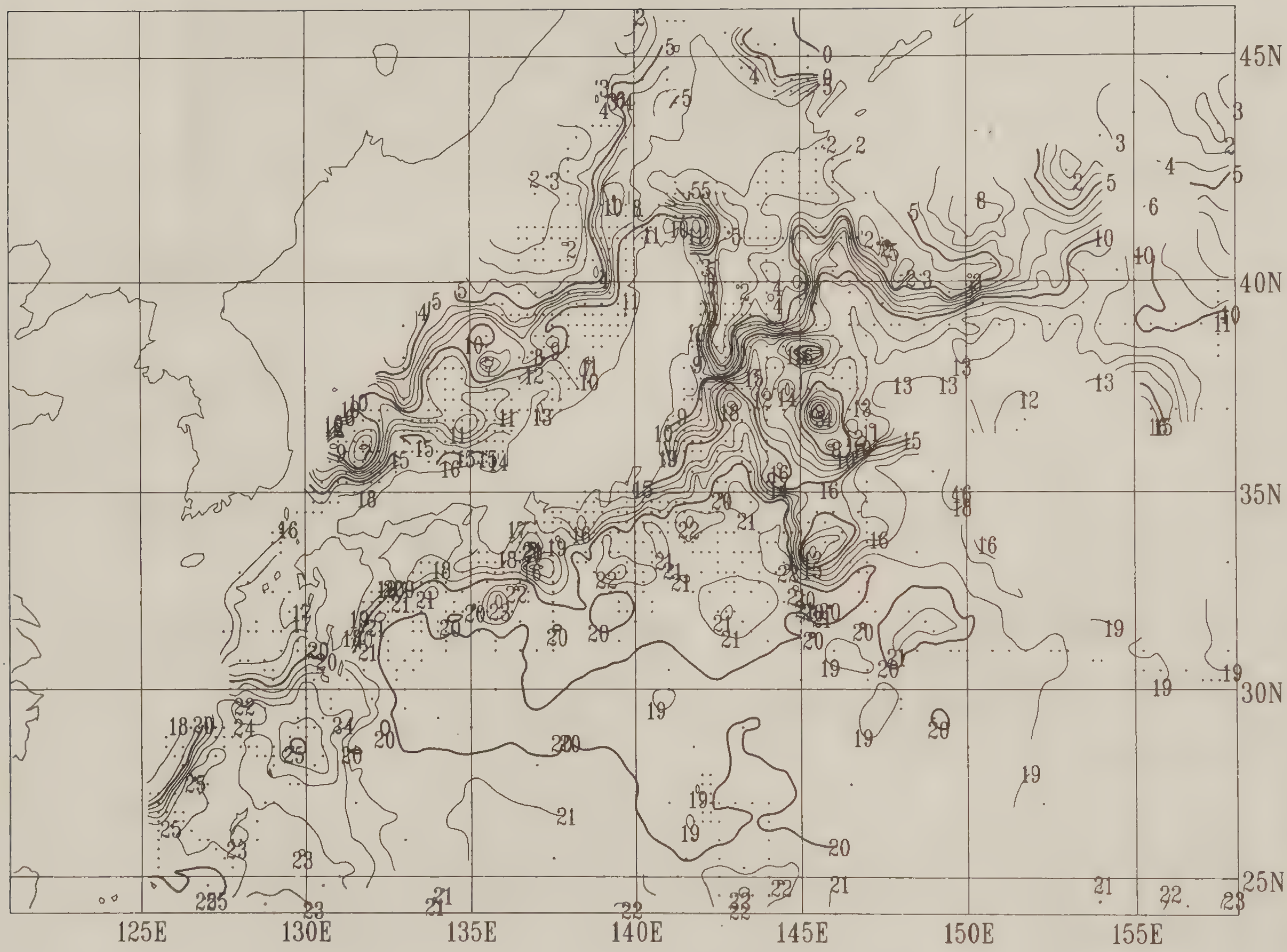
第3図 北西太平洋旬平均海面水温図(上)及び偏差図(下)(1998年 6月下旬)

Fig.3 Ten-day mean SST (top) and anomalies (bottom) in the western North Pacific for the 3rd ten-day period in JUN 1998. Anomalies are computed from the JMA climatology (1961-90). Contour interval is 1°C and additional anomaly contours of 0.5°C are shown by broken lines. Negative anomalies are spotted.



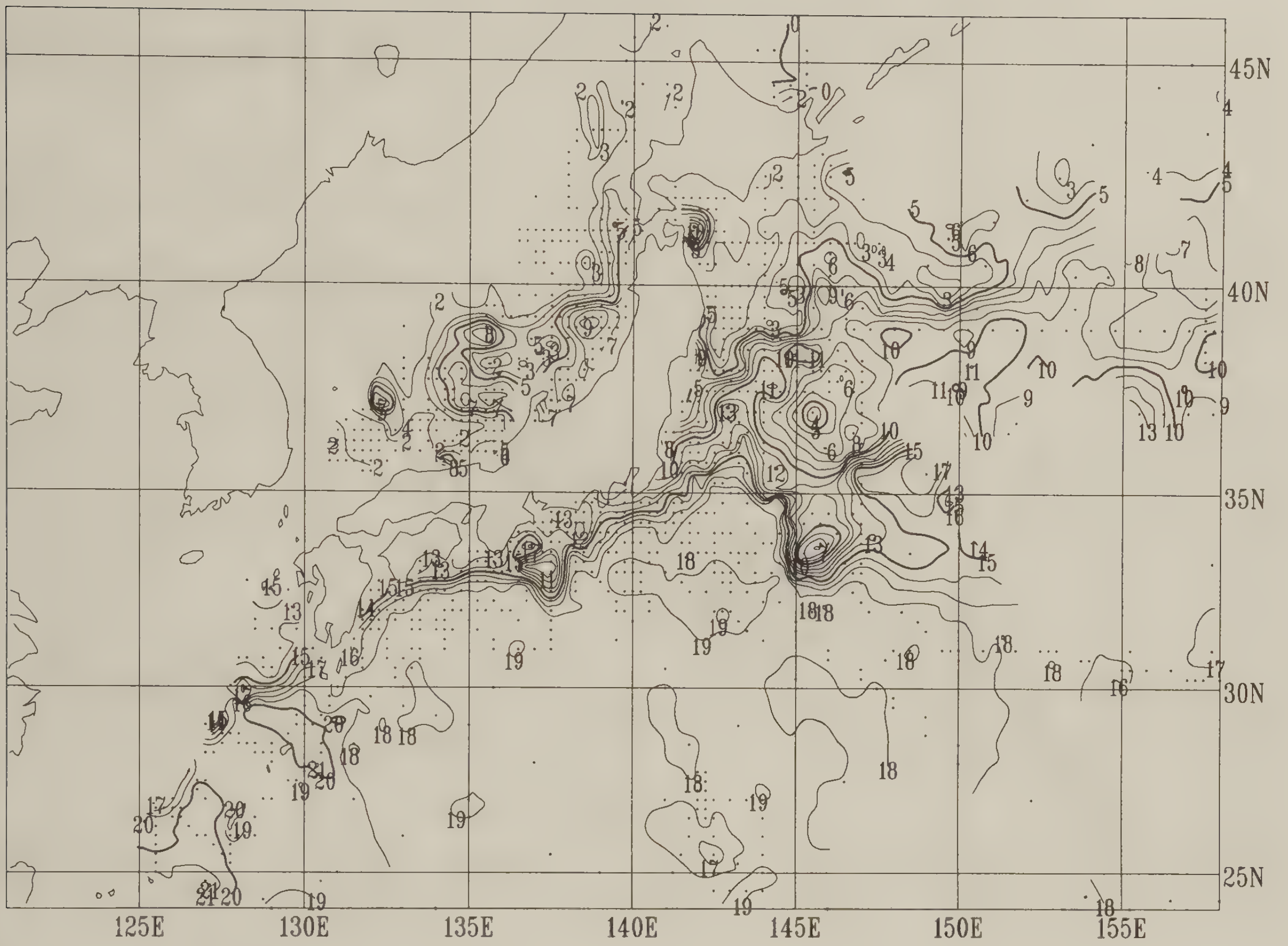
第4図 北西太平洋月平均海面水温図(上)及び偏差図(下)(1998年 6月)

Fig.4 Monthly mean SST (top) and anomalies (bottom) in the western North Pacific for JUN 1998. Anomalies are computed from the JMA climatology (1961-1990). Contour interval is 1°C and additional anomaly contours of 0.5°C are shown by broken lines. Negative anomalies are spotted.



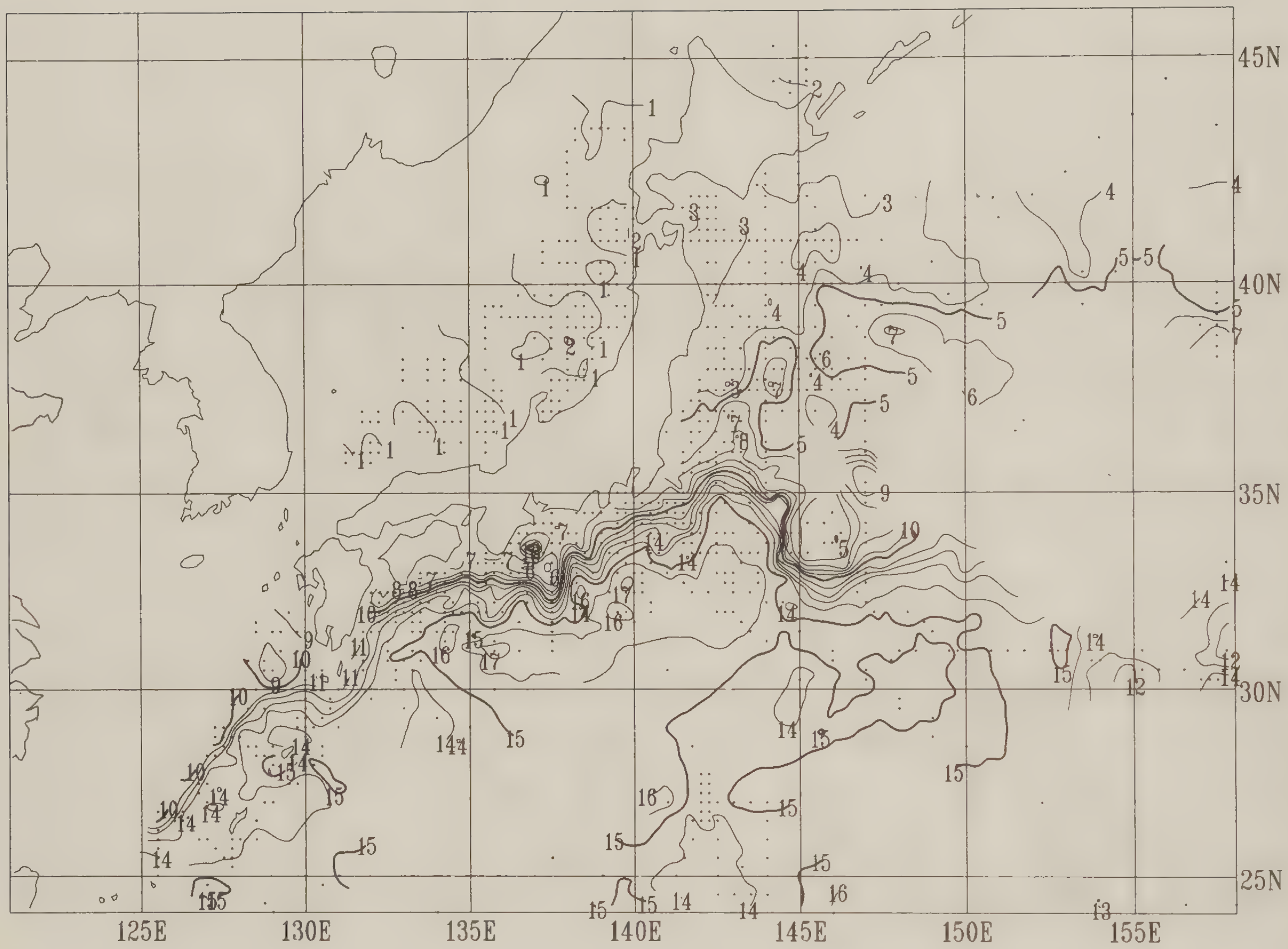
第5図　日本近海表層水温図(深さ100m)（1998年 6月）

Fig.5 Subsurface (100m) temperatures in the seas adjacent to Japan for JUN 1998. Contour interval is 1°C. Observation points are denoted by dots.



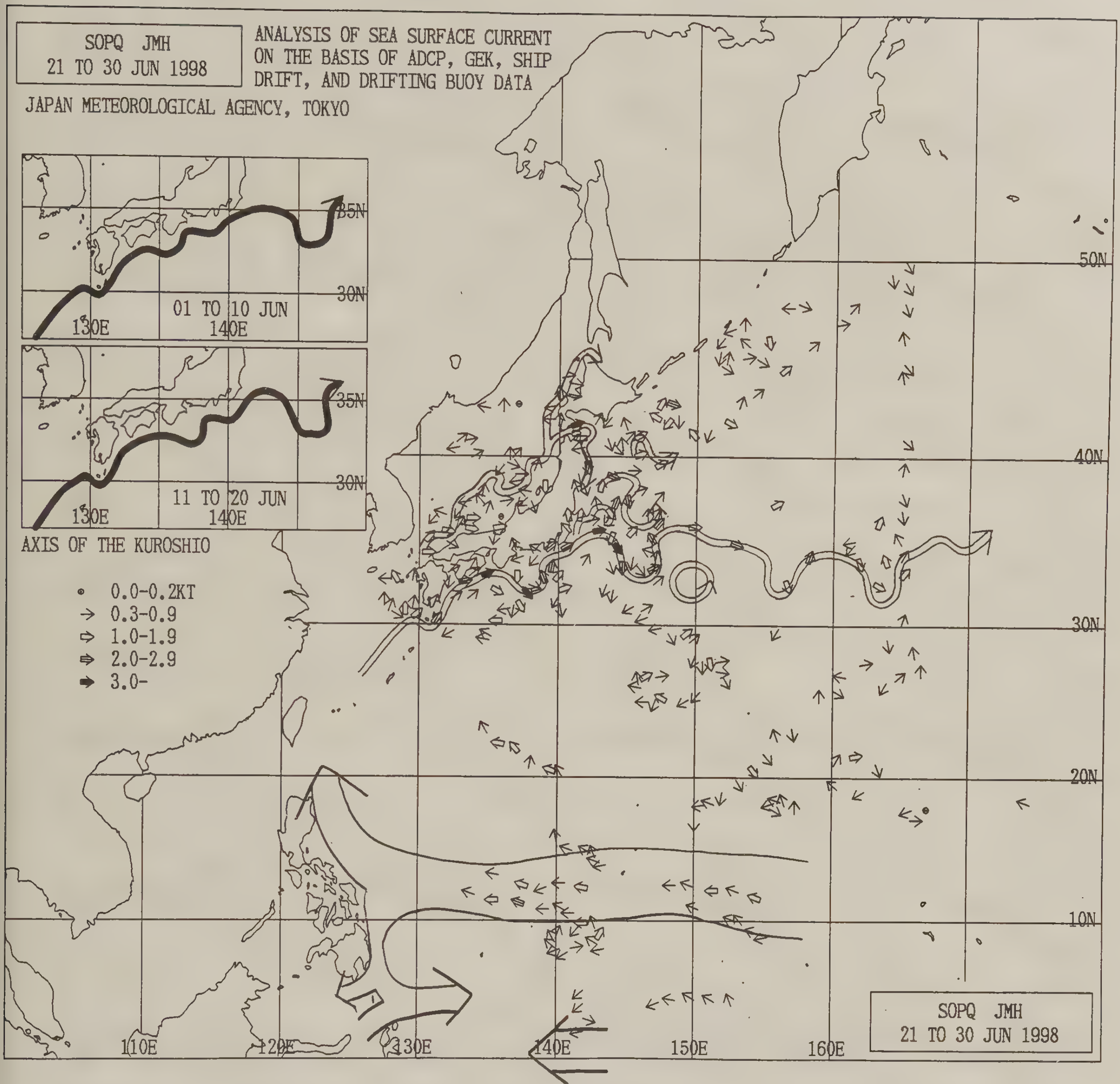
第6図　日本近海表層水温図(深さ200m) (1998年 6月)

Fig.6 Subsurface (200m) temperatures in the seas adjacent to Japan for JUN 1998. Contour interval is 1°C. Observation points are denoted by dots.



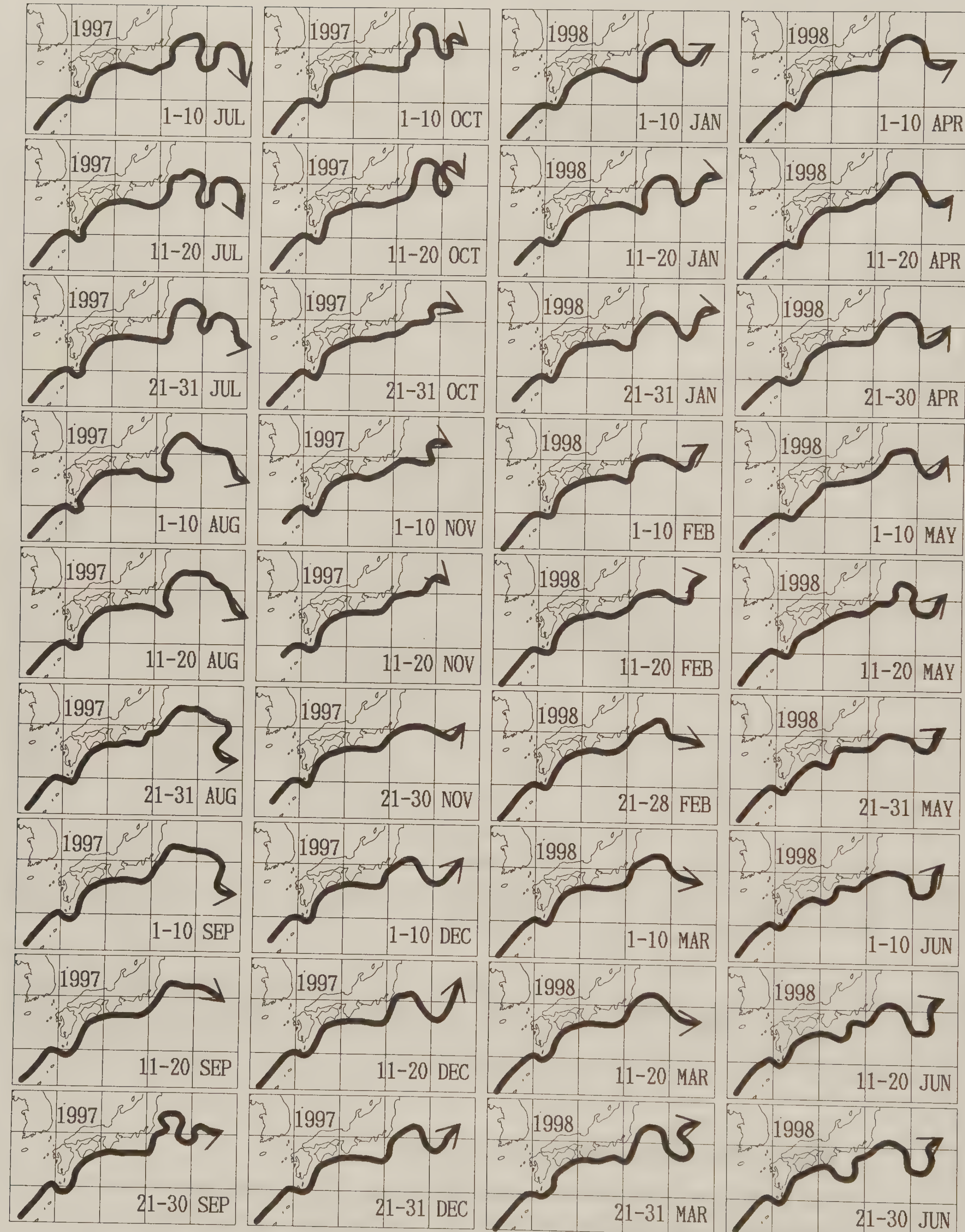
第7図　日本近海表層水温図(深さ400m) (1998年 6月)

Fig.7 Subsurface (400m) temperatures in the seas adjacent to Japan for JUN 1998. Contour interval is 1°C. Observation points are denoted by dots.



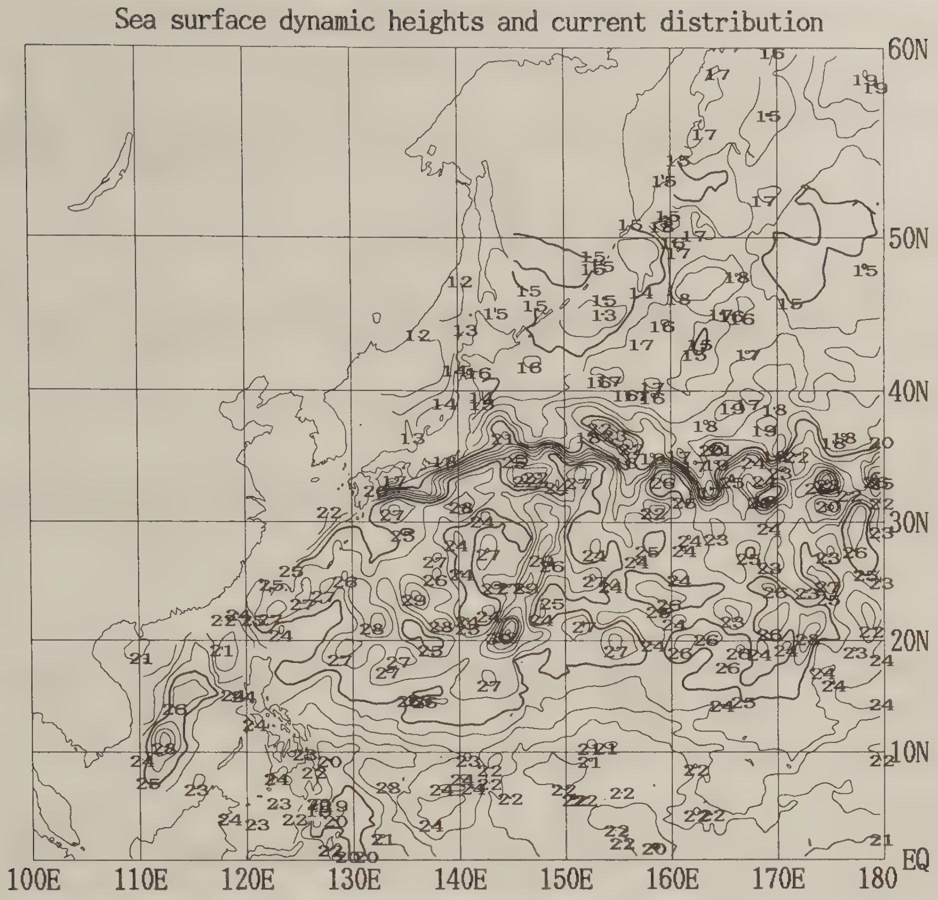
第8図　北西太平洋海流図 (1998年 6月下旬)

Fig.8 Analysis of the sea surface current in the western North Pacific for the 3rd ten-day period in JUN 1998. Small arrows indicate in situ observations. Major currents such as the Kuroshio and the North Equatorial Current are denoted by larger open arrows.



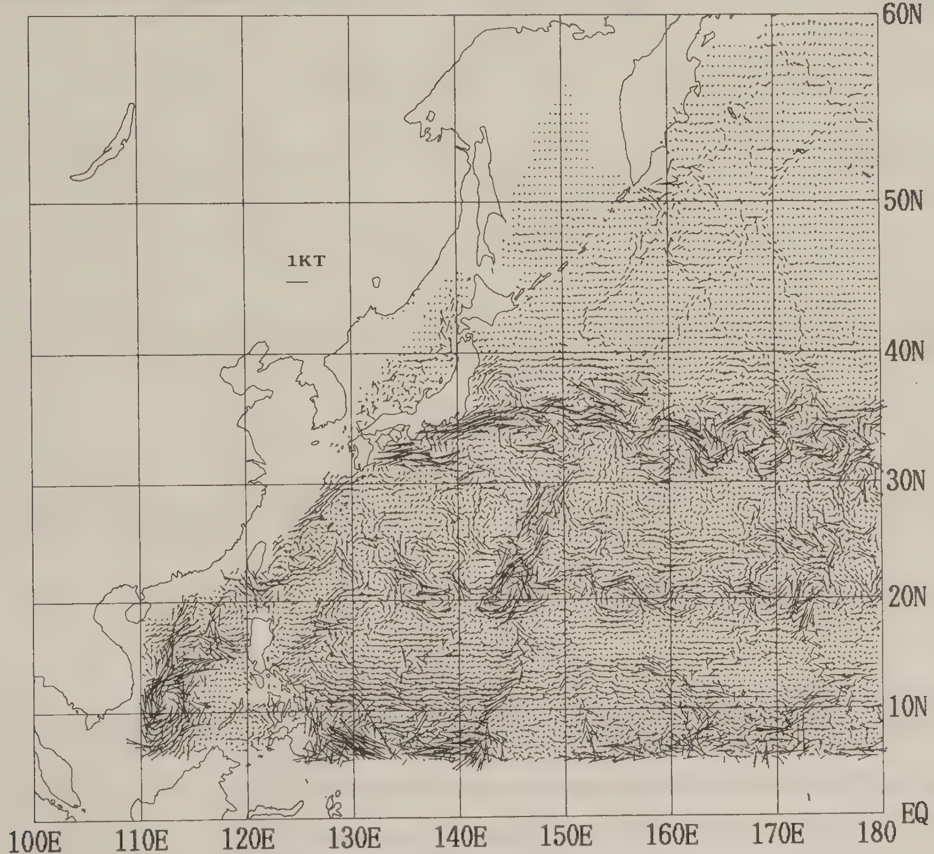
第9図 旬別黒潮流軸図

Fig.9 Location of the Kuroshio axis



第10図 北西太平洋力学的海面高度分布図(1998年 6月21日)

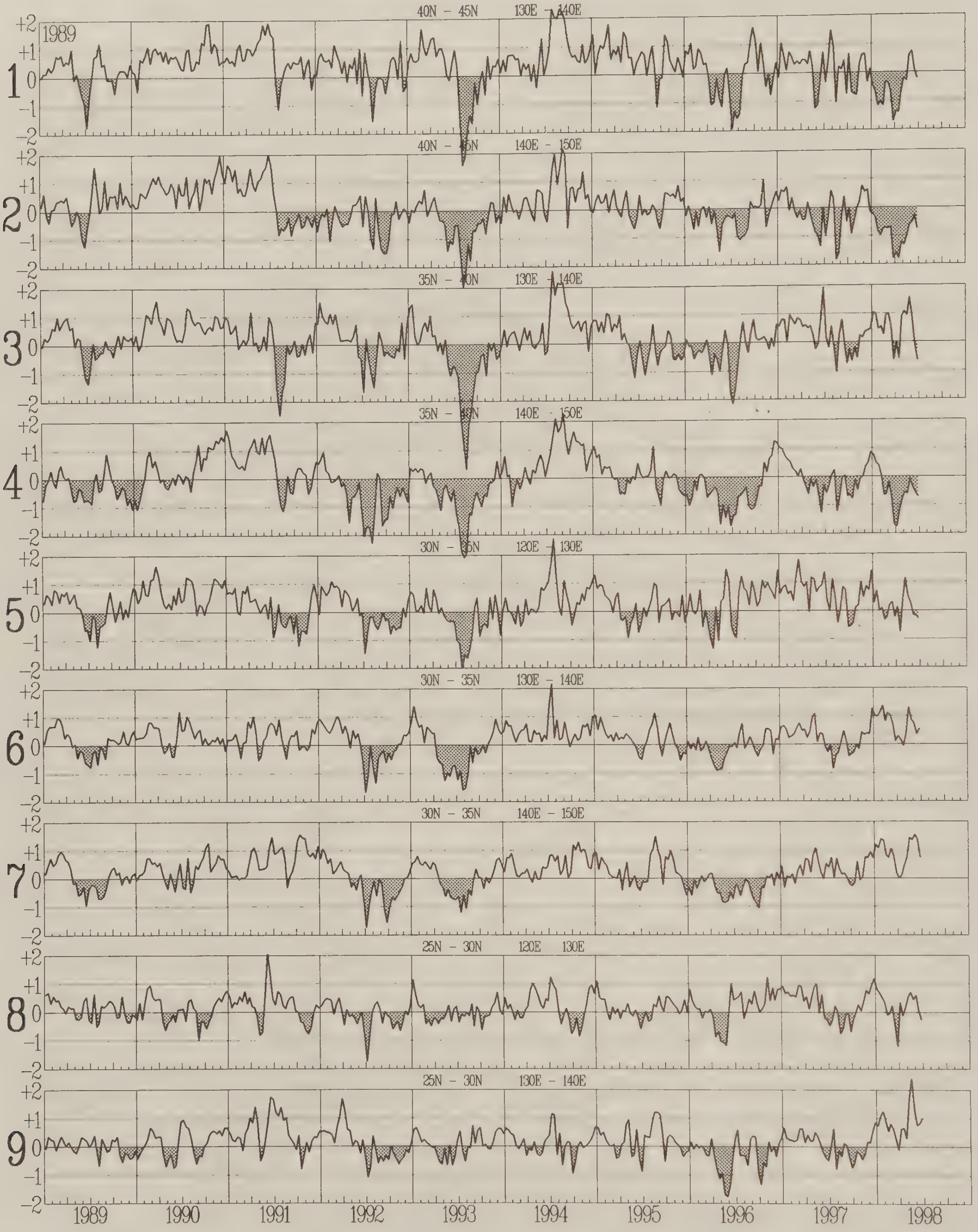
Fig.10 Sea surface dynamic heights (10cm) in the western North Pacific derived from the altimeter data of TOPEX/POSEIDON (JUN 21, 1998).
1500db surface is assumed to be the surface of no motion.

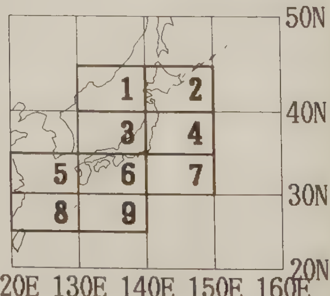


第11図 北西太平洋海流ベクトル図(1998年 6月21日)

Fig.11 Sea surface current vectors in the western North Pacific (JUN 21, 1998).
Vectors are derived from the sea surface dynamic heights from TOPEX/POSEIDON and subsurface temperature distribution assuming the geostrophic relation.

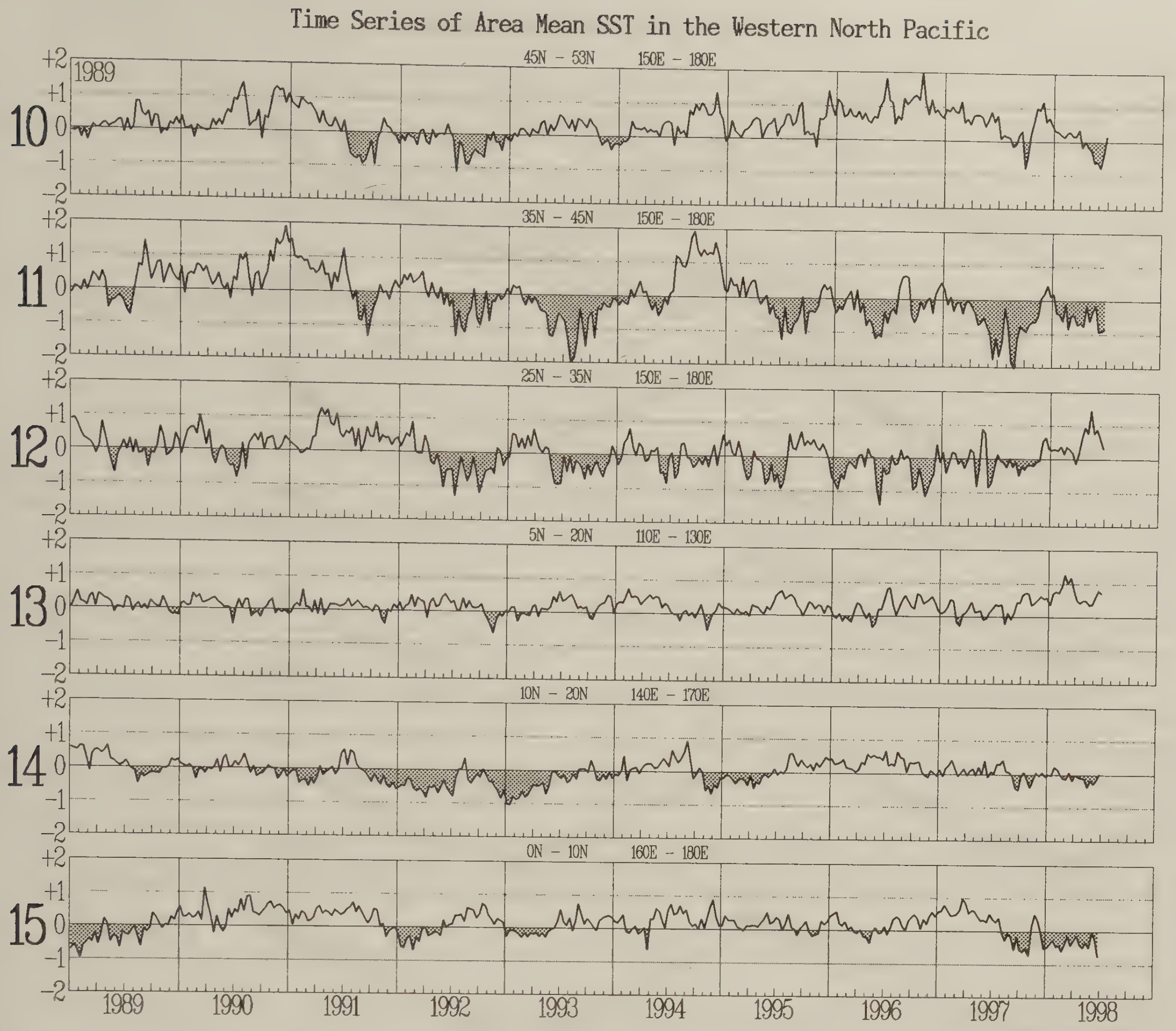
Time Series of Area Mean SST in the Western North Pacific





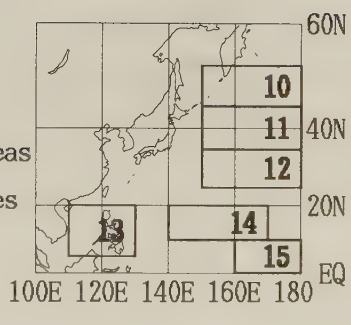
第12図 海域別旬平均海面水温平年偏差時系列図

Fig.12 Time series of the ten-day mean sea surface temperature anomalies (°C) in the western North Pacific for the areas shown in the right panel. Negative anomalies are shaded. Anomalies are computed from the JMA climatology (1961-90).

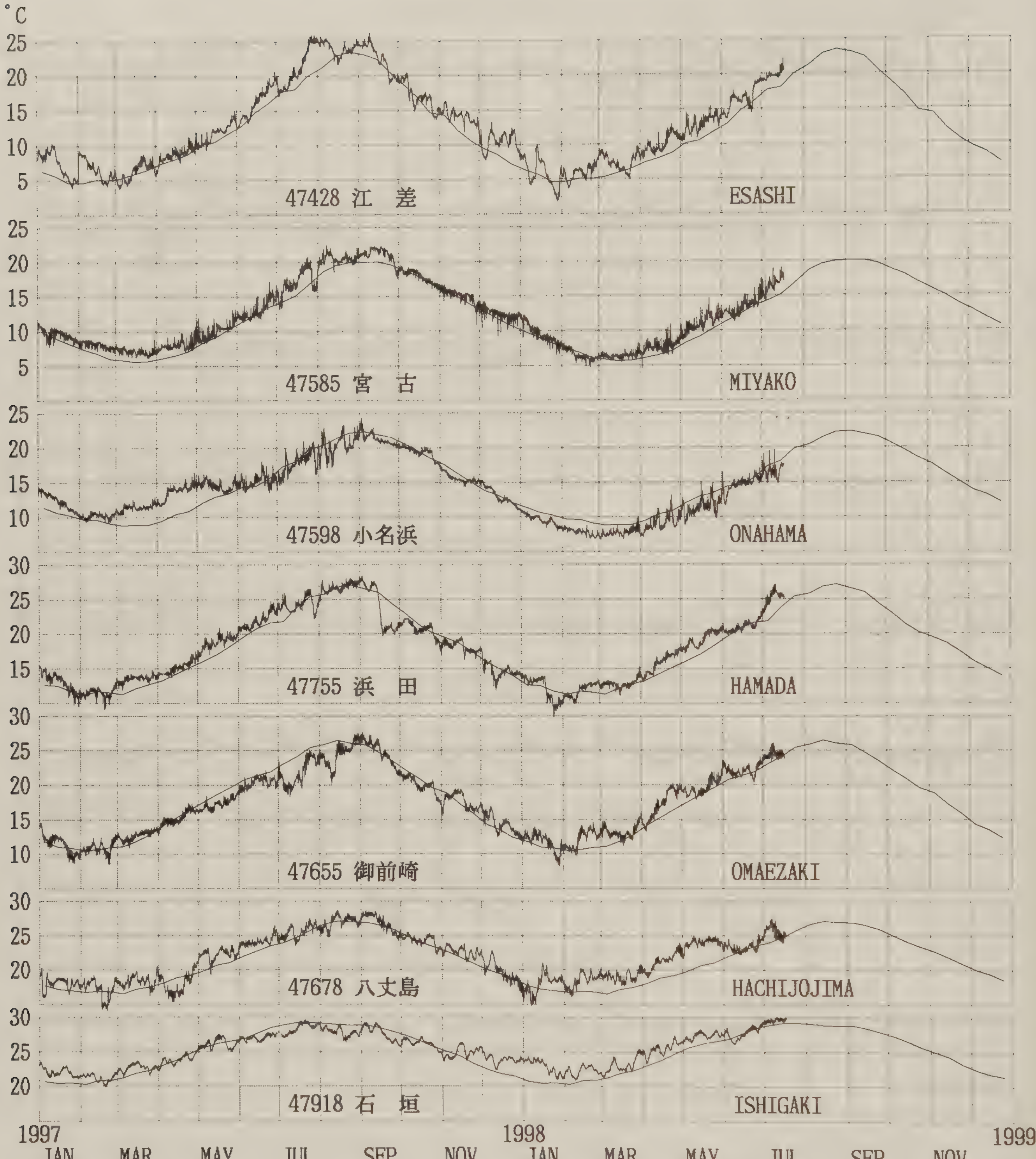


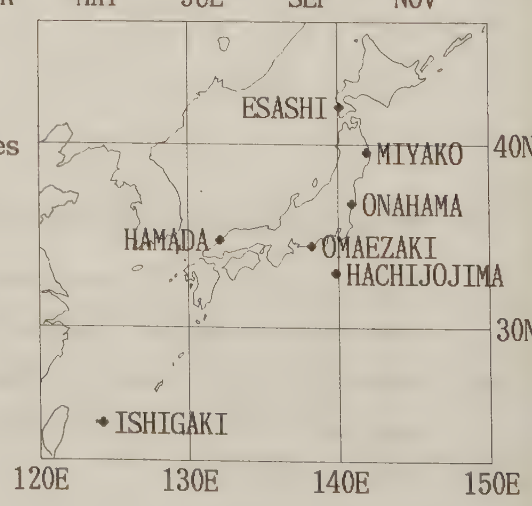
第12図　海域別旬平均海面水温平年偏差時系列図（つづき）

Fig.12 (continue) Time series of the ten-day mean sea surface temperature anomalies (°C) in the western North Pacific for the areas shown in the right panel. Negative anomalies are shaded. Anomalies are computed from the JMA climatology (1961-90).



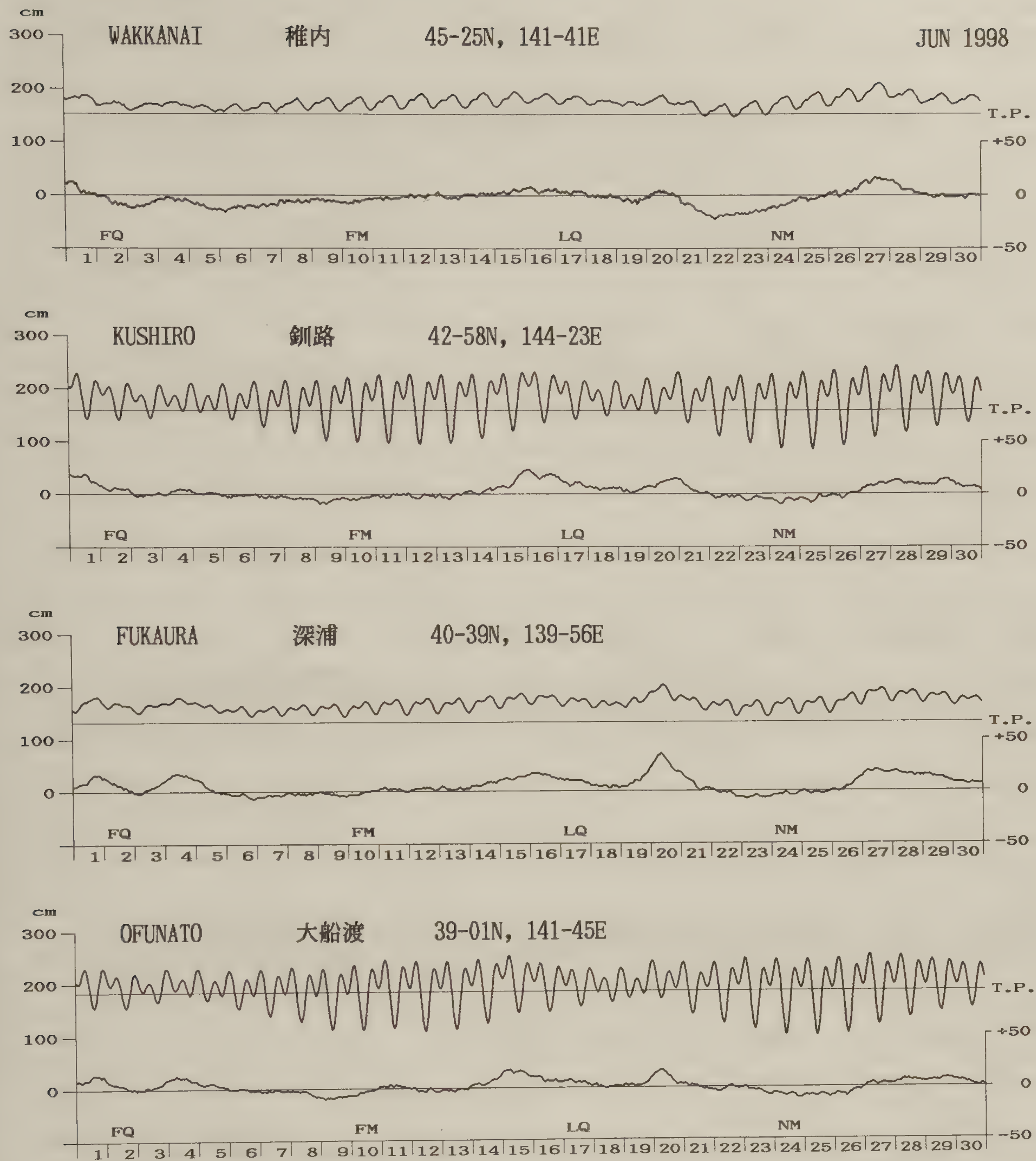
Coastal Water Temperatures





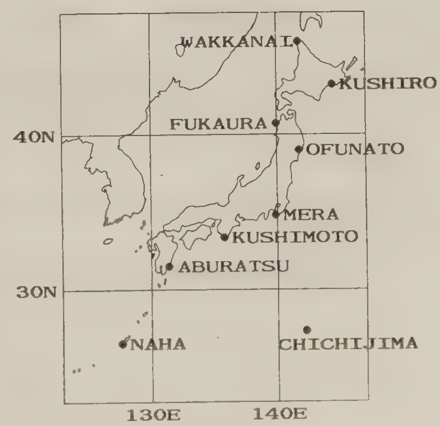
第13図 沿岸水温時系列図

Fig.13 Time series of hourly coastal water temperatures (˚C) measured at 7 coastal stations of the JMA shown in the right panel.
Thin lines show ten-day mean climatology.

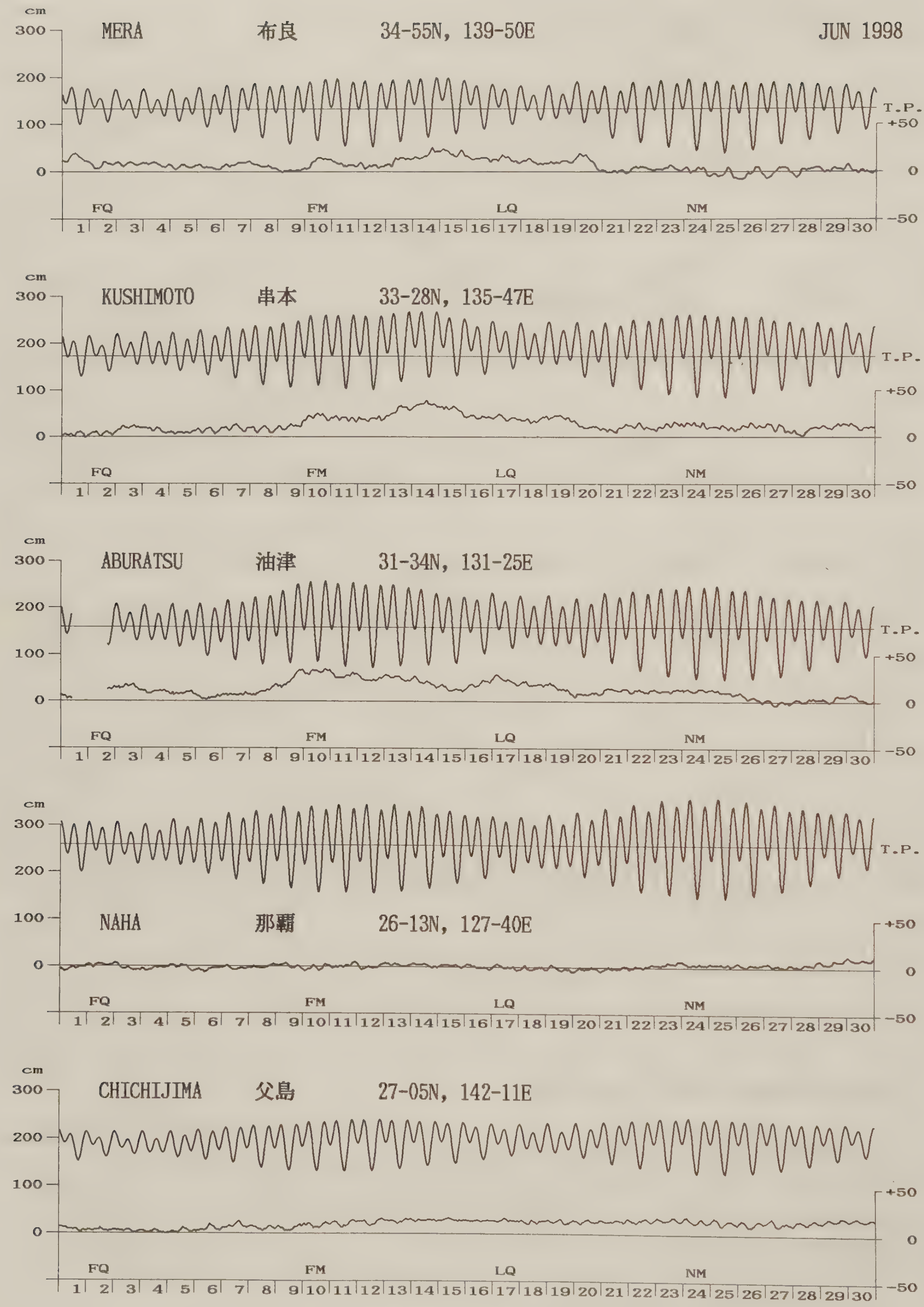


第14図 沿岸潮位時系列図 (1998年 6月)

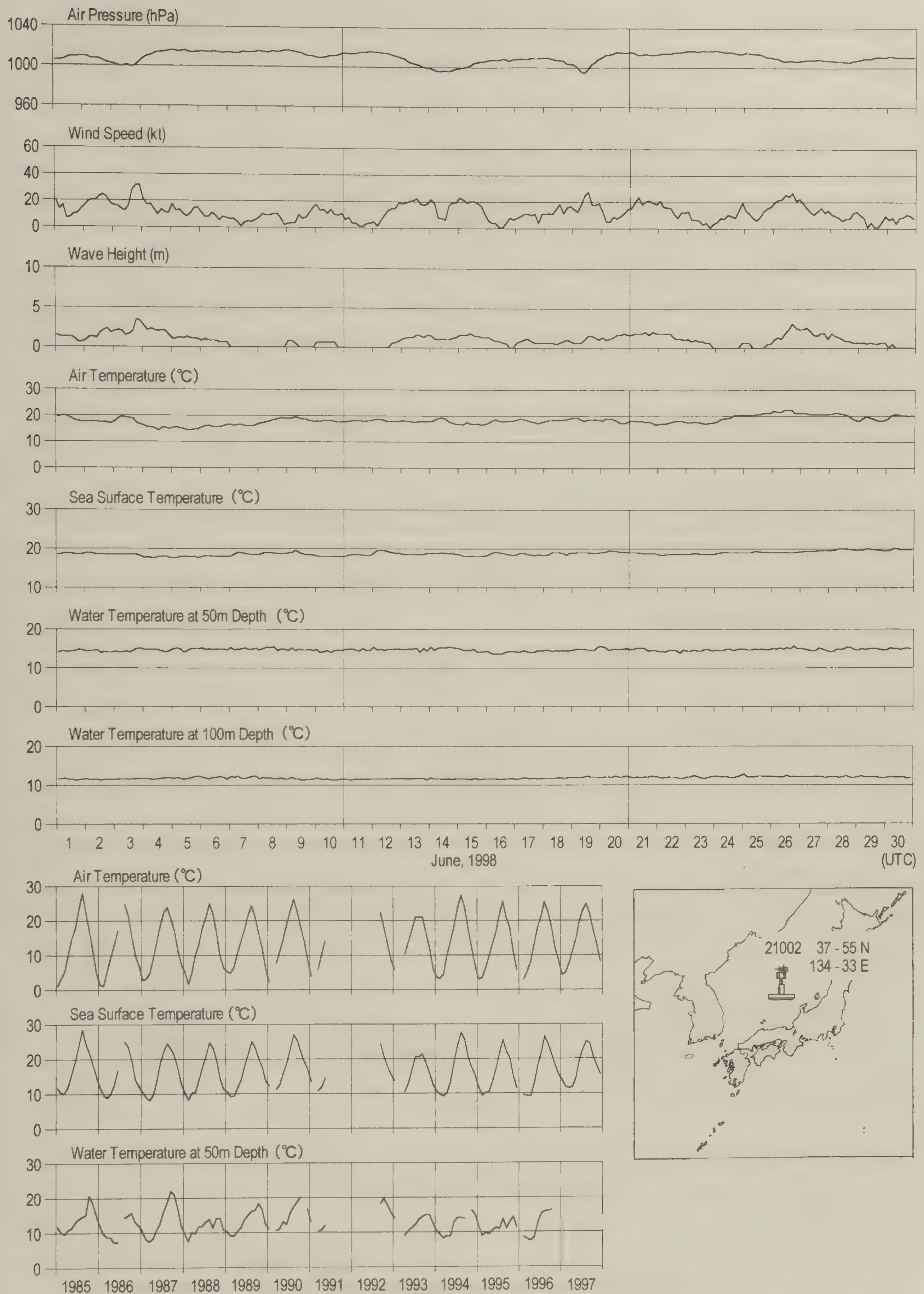
Fig.14 Time series of hourly sea level observation (upper line) and its anomalies (lower line) at 9 stations of the JMA in the right panel.
Short term variations are removed from raw data.



FM: full moon, FQ: first quarter
NM: new moon, LQ: last quarter
T.P.: Mean sea level of Tokyo Bay (Tokyo Peil)

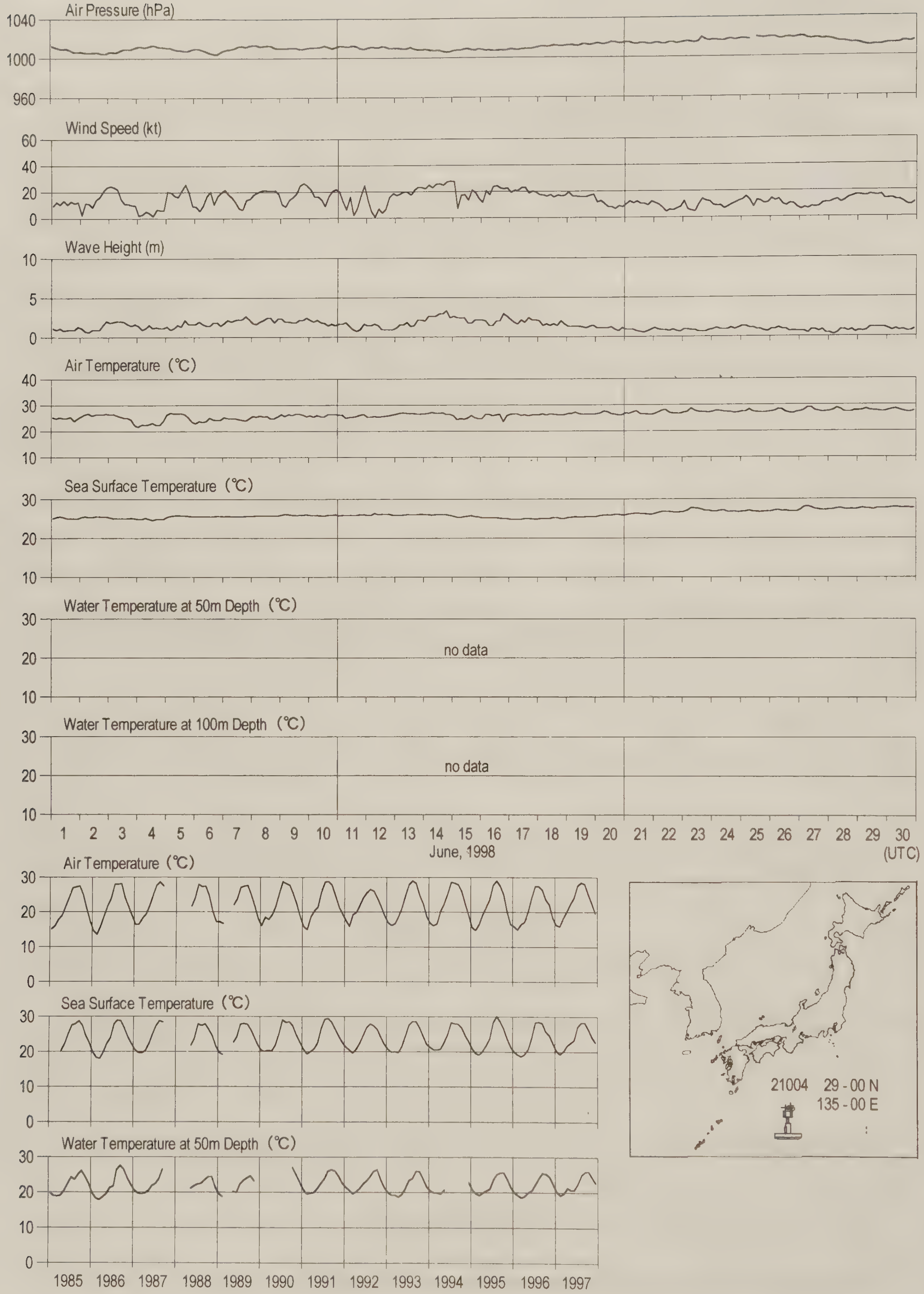


第14図 つづき
Fig.14 continue



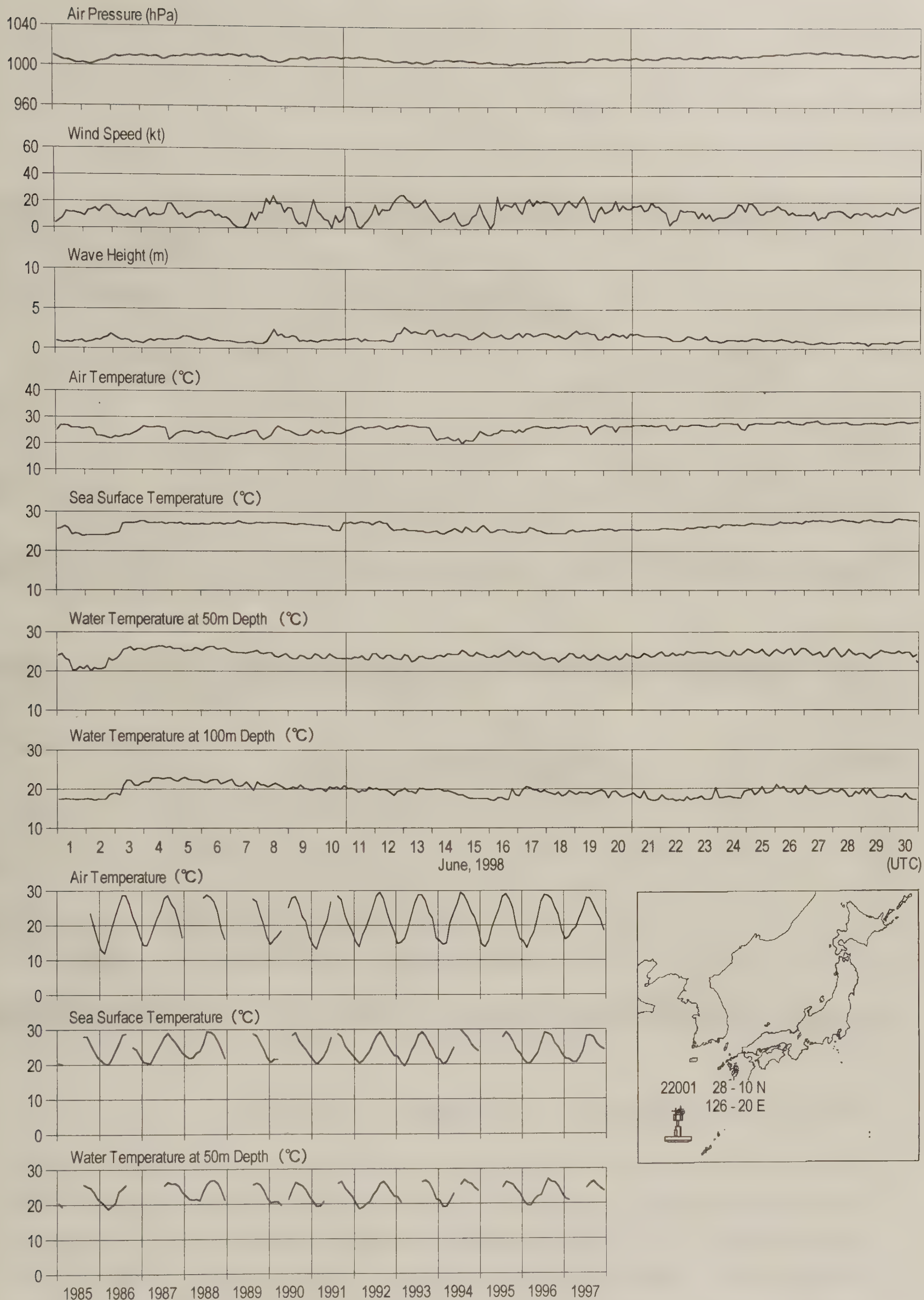
第15図　海洋気象ブイロボットによる観測要素の時系列図（日本海：21002）
上段は３時間毎の観測値を、下段は月平均値を示す。

Fig. 15　Time series of JMA buoy observation in the Japan Sea (WMO ID No. 21002). The upper panel shows three hourly observation and the lower panel shows the monthly mean data.



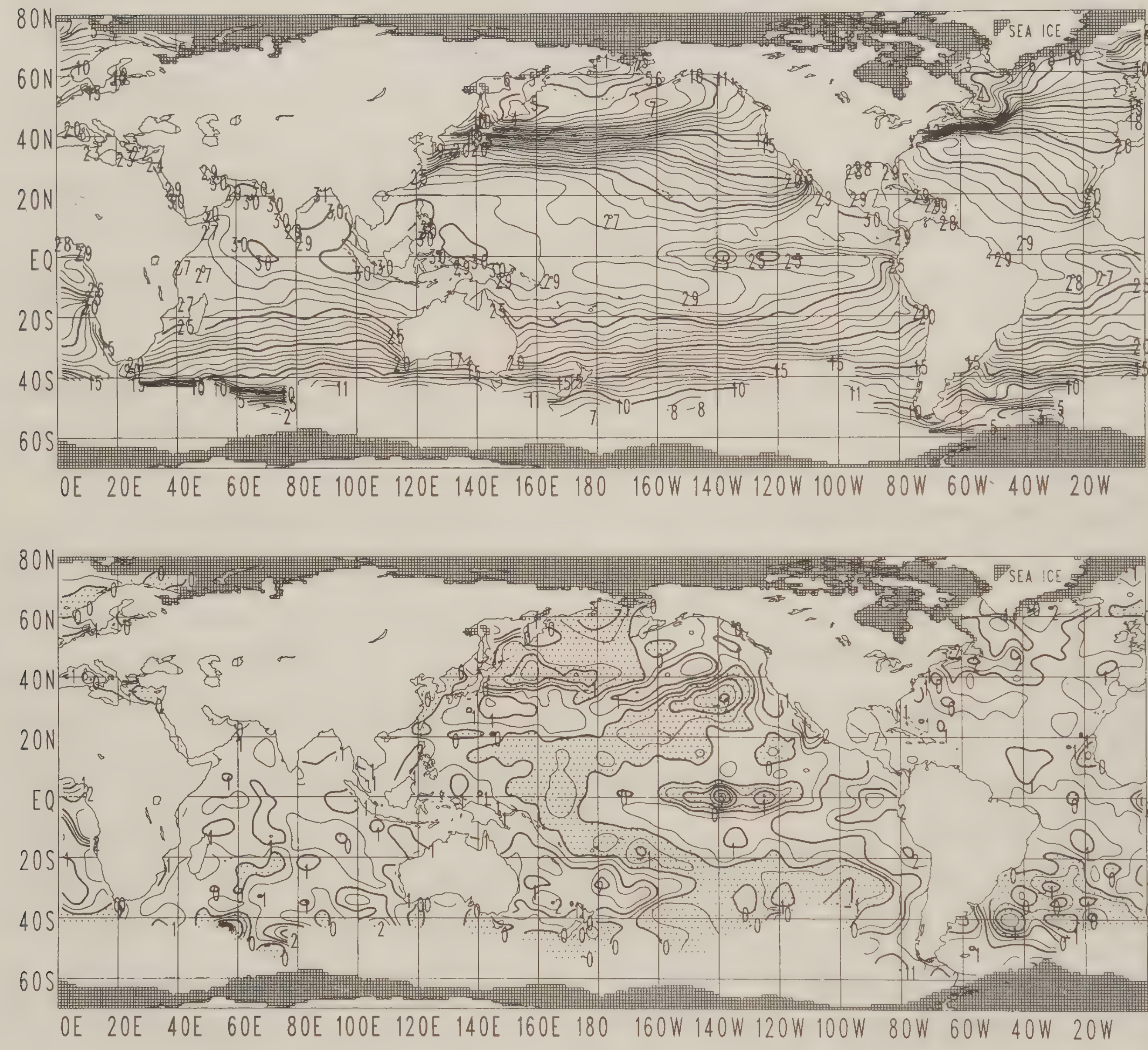
第15図　海洋気象ブイロボットによる観測要素の時系列図（四国沖：21004）
上段は３時間毎の観測値を、下段は月平均値を示す。

Fig. 15　Time series of JMA buoy observation south of Shikoku (WMO ID No. 21004). The upper panel shows three hourly observation and the lower panel shows the monthly mean data.



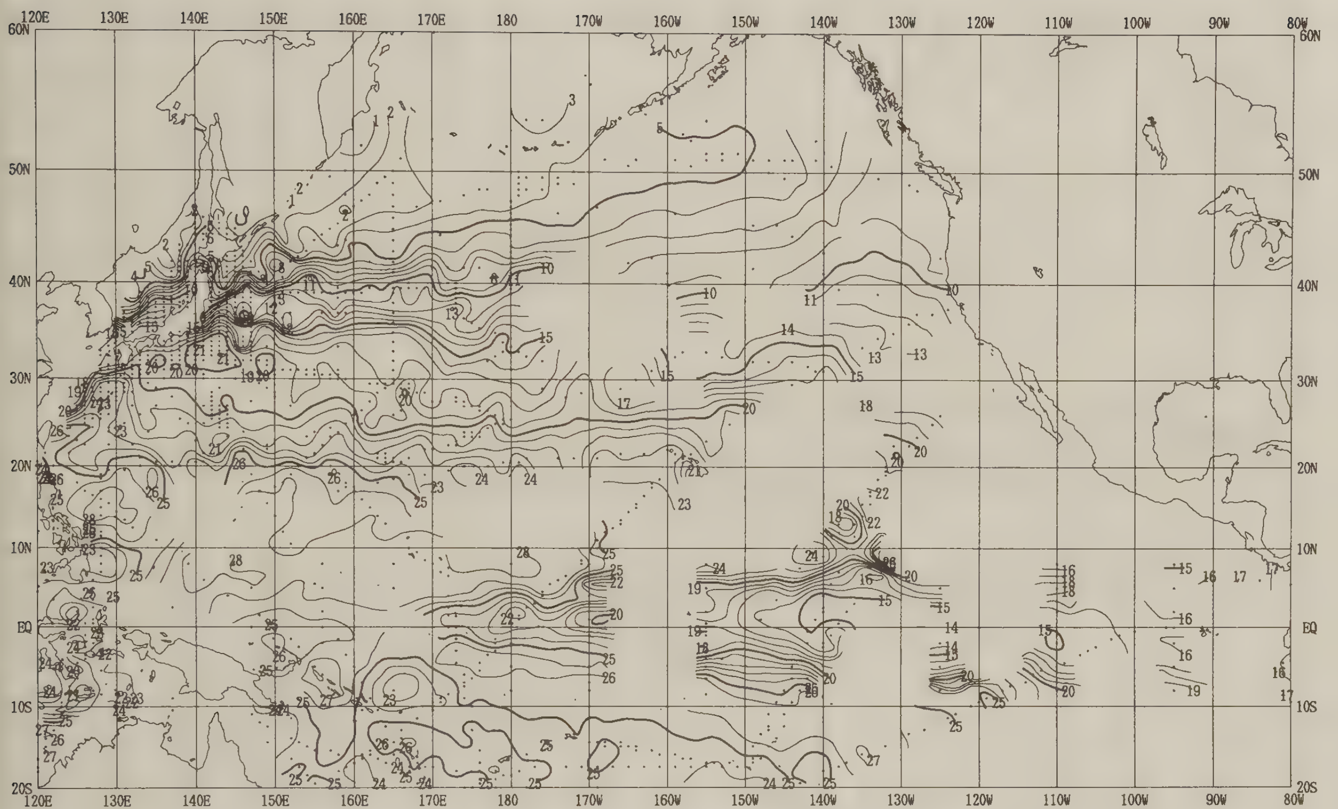
第15図　海洋気象ブイロボットによる観測要素の時系列図（東シナ海：22001）
上段は３時間毎の観測値を、下段は月平均値を示す。

Fig. 15　Time series of JMA buoy observation in the East China Sea (WMO ID No. 22001). The upper panel shows three hourly observation and the lower panel shows the monthly mean data.



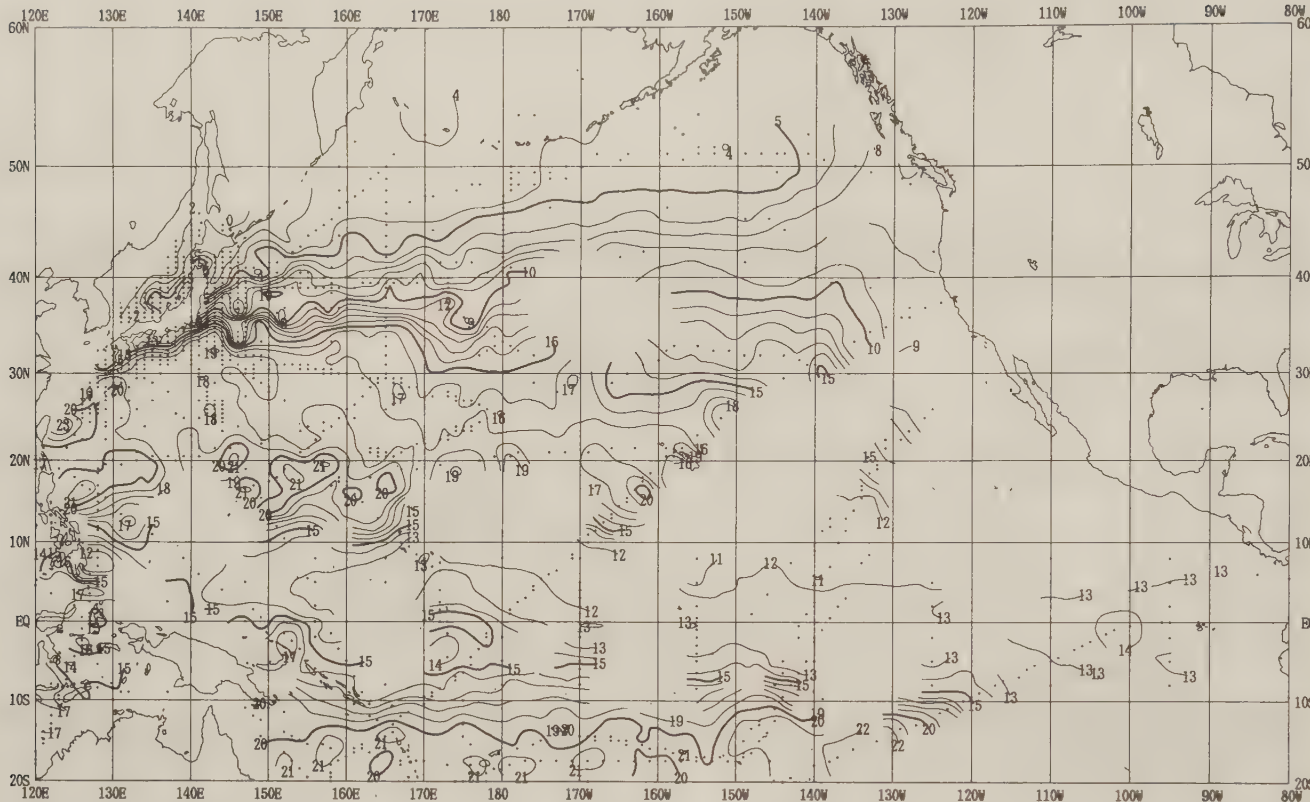
第16図　全球月平均海面水温図（上）及び偏差図（下）（1998年 6月）

Fig.16 Monthly mean sea surface temperature over the global ocean (top) and anomalies (bottom) for JUN 1998. Anomalies are computed from the JMA climatology (1961-1990). Contour interval is 1°C (top) and additional anomaly contours of ±0.5°C are shown by thin lines. Negative anomalies are spotted. Maximum coverage of sea ice is shaded. Data sources for sea ice are U.S. National Ice Center (polar regions) and JMA (the Sea of Okhotsk).



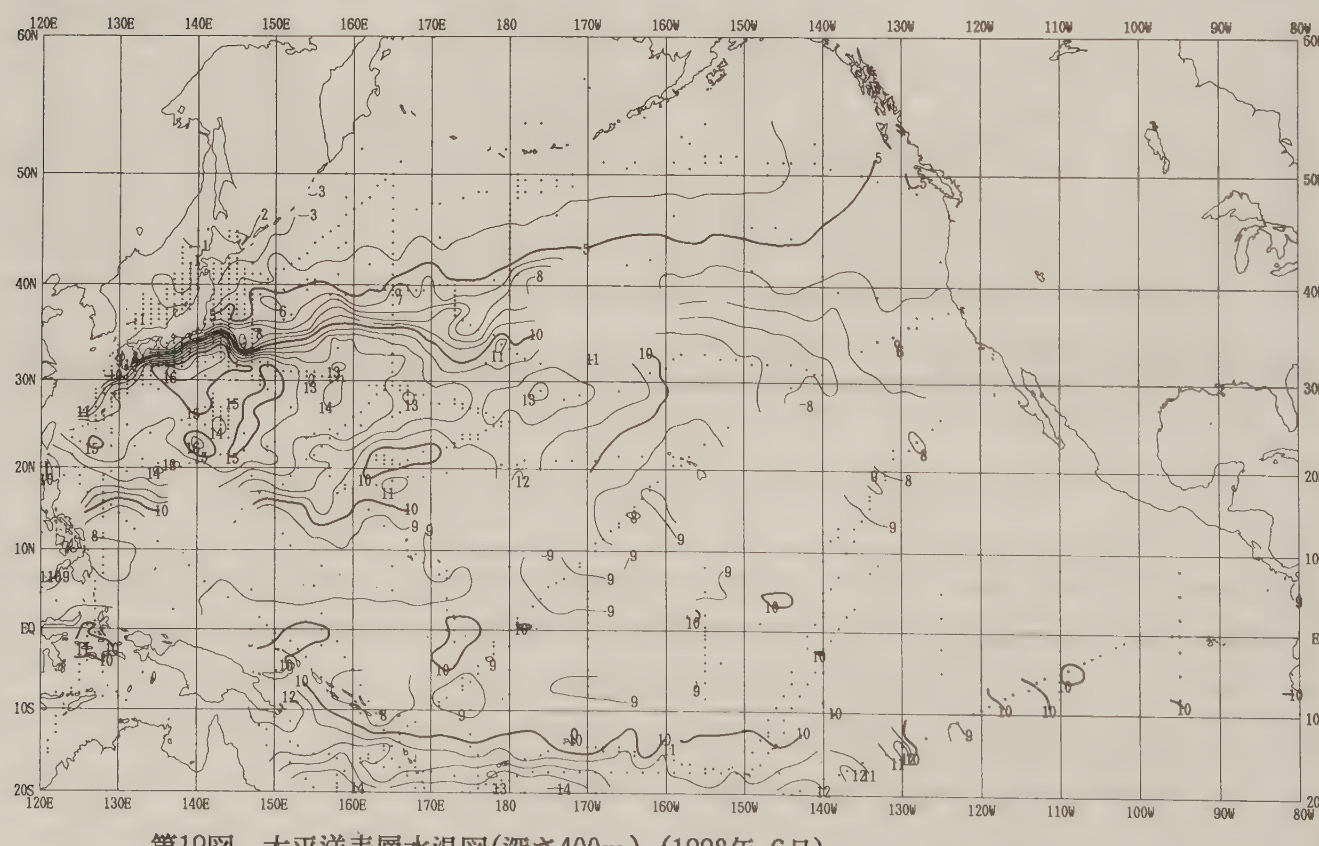
第17図　太平洋表層水温図(深さ100m)（1998年 6月）

Fig.17　Subsurface (100m) temperatures in the Pacific Ocean for JUN 1998.
Contour interval is 1°C.　Observation points are denoted by dots.



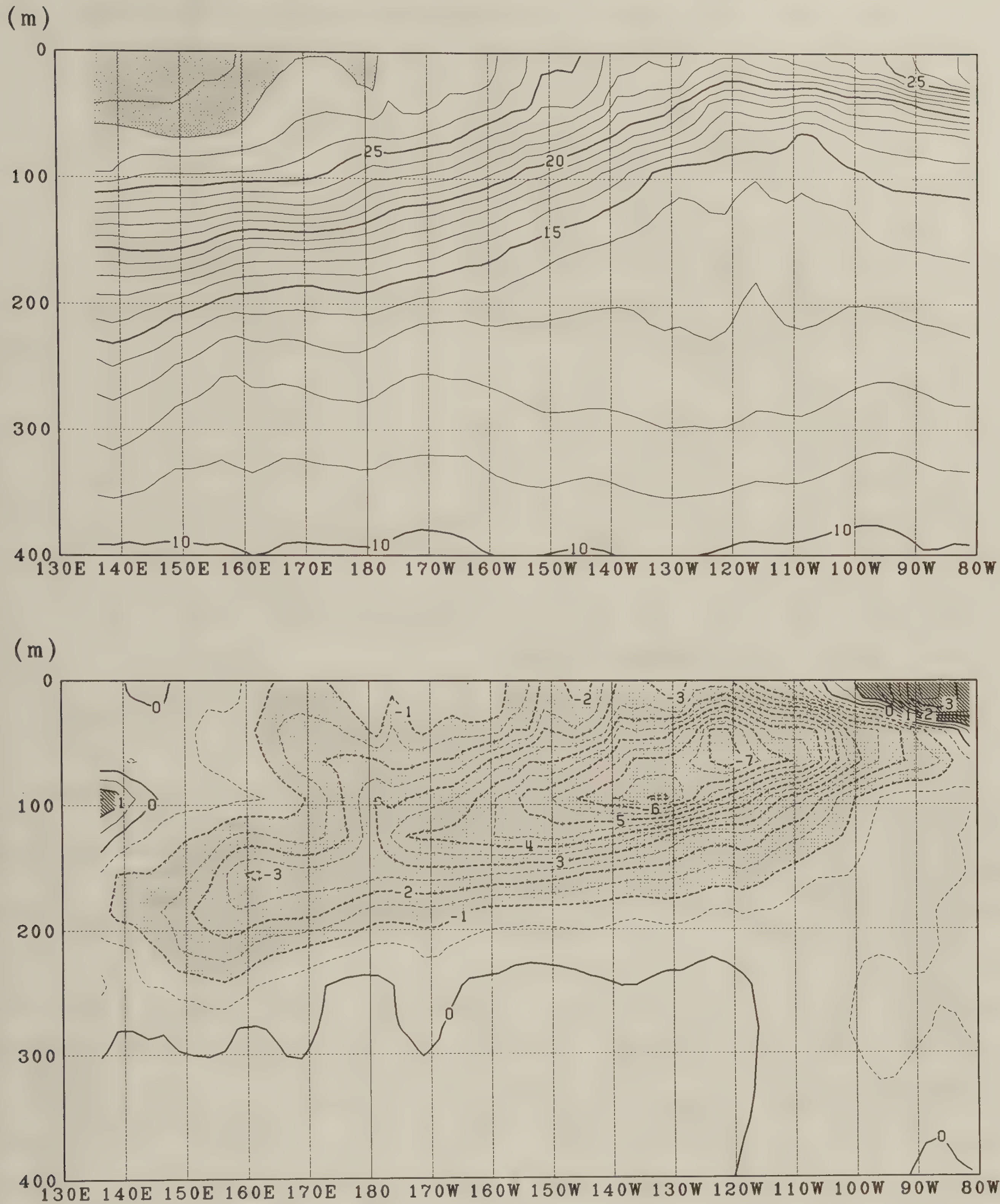
第18図　太平洋表層水温図(深さ200m) (1998年 6月)

Fig.18 Subsurface (200m) temperatures in the Pacific Ocean for JUN 1998.
Contour interval is 1°C. Observation points are denoted by dots.



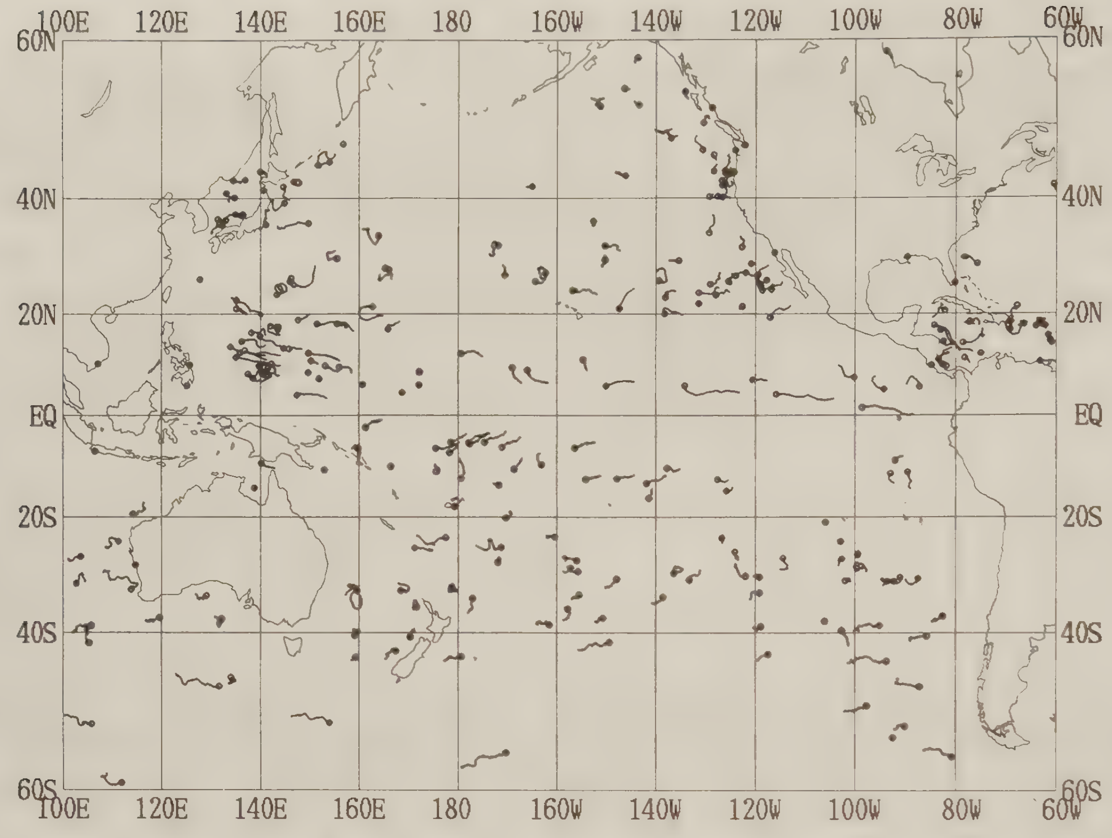
第19図　太平洋表層水温図(深さ400m) (1998年 6月)

Fig.19 Subsurface (400m) temperatures in the Pacific Ocean for JUN 1998.
Contour interval is 1°C. Observation points are denoted by dots.



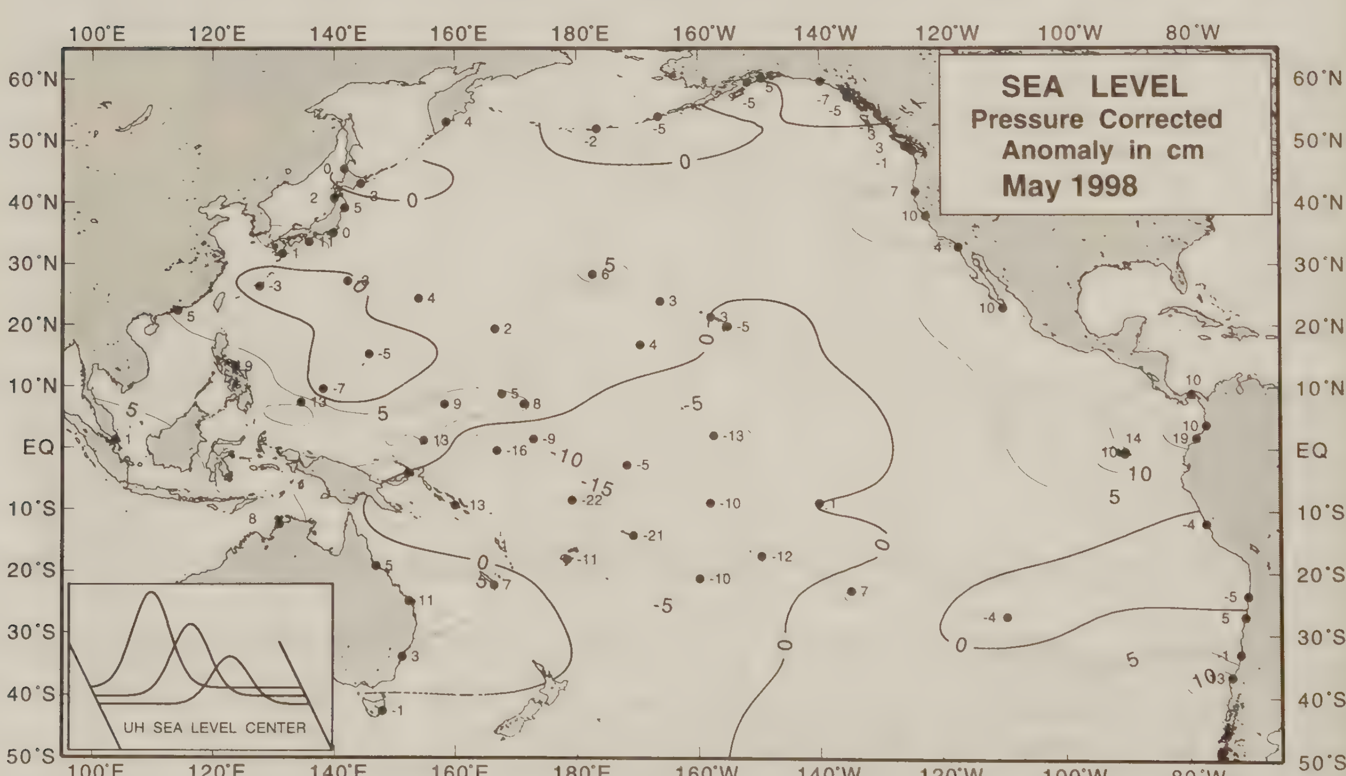
第20図　太平洋赤道に沿う表層水温（上）及び偏差（下）の深度－経度断面図（1998年 6月）

Fig.20 Depth-longitude sections of temperature (top) and anomalies (bottom) along the equator in the Pacific Ocean for JUN 1998. Data are derived from the Ocean Data Assimilation System of JMA. Contour interval is 1°C (top) and 0.5°C (bottom). Values greater than 28°C in the top panel are shaded. In the bottom panel, values greater than 1°C are shaded and values less than -1°C are spotted. Anomalies are computed from 1987-1997 base period means.



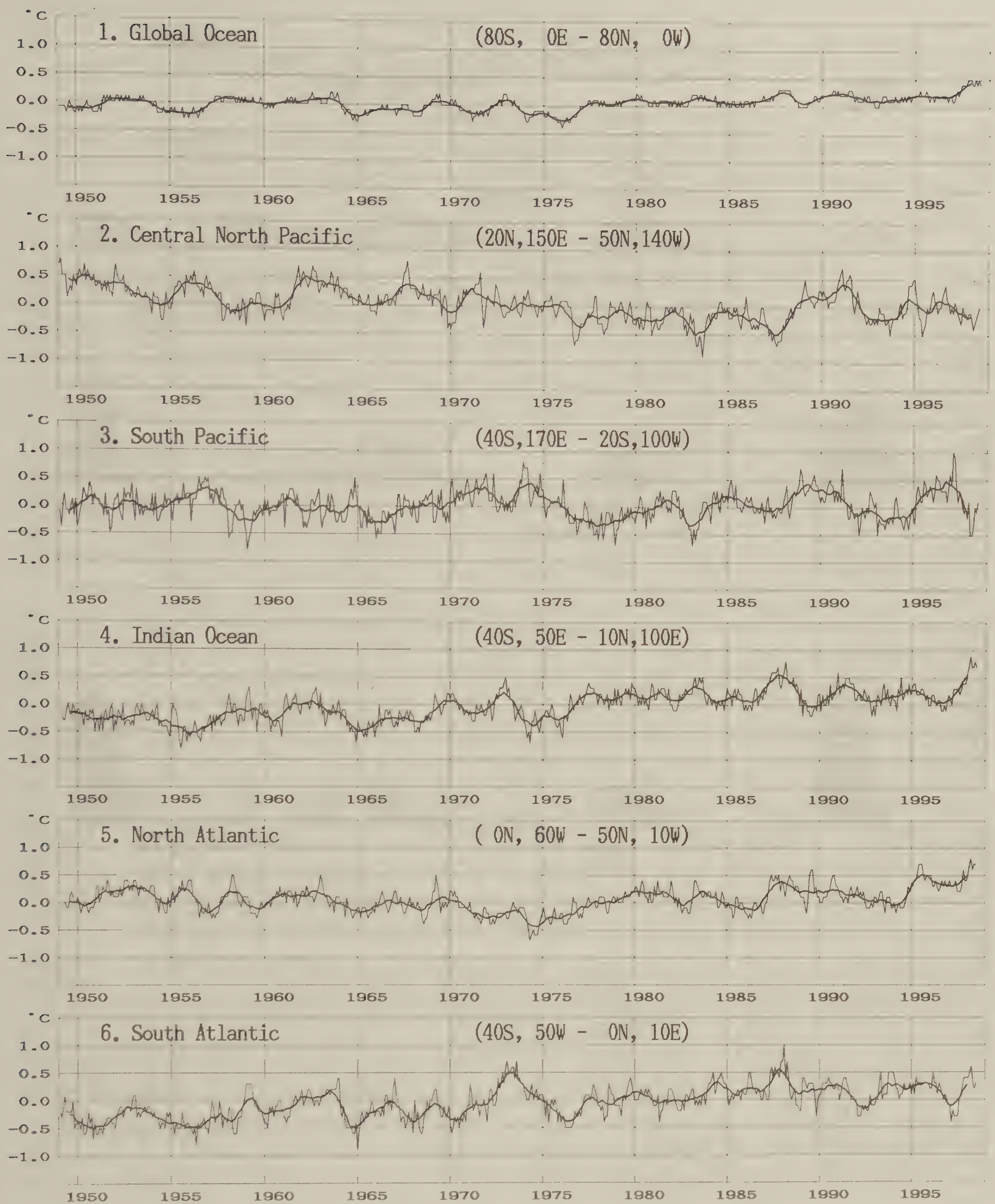
第21図　太平洋ブイ流跡図(1998年 6月)

Fig.21 Movements of drifting buoys in the Pacific Ocean during JUN 1998. Each track is for one buoy. Small circles represent last positions for the month.



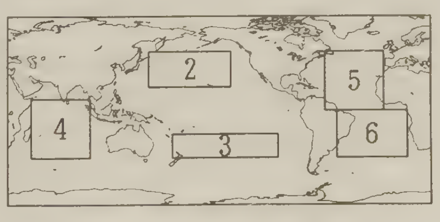
第22図　太平洋海面水位偏差図 (1998年 5月)

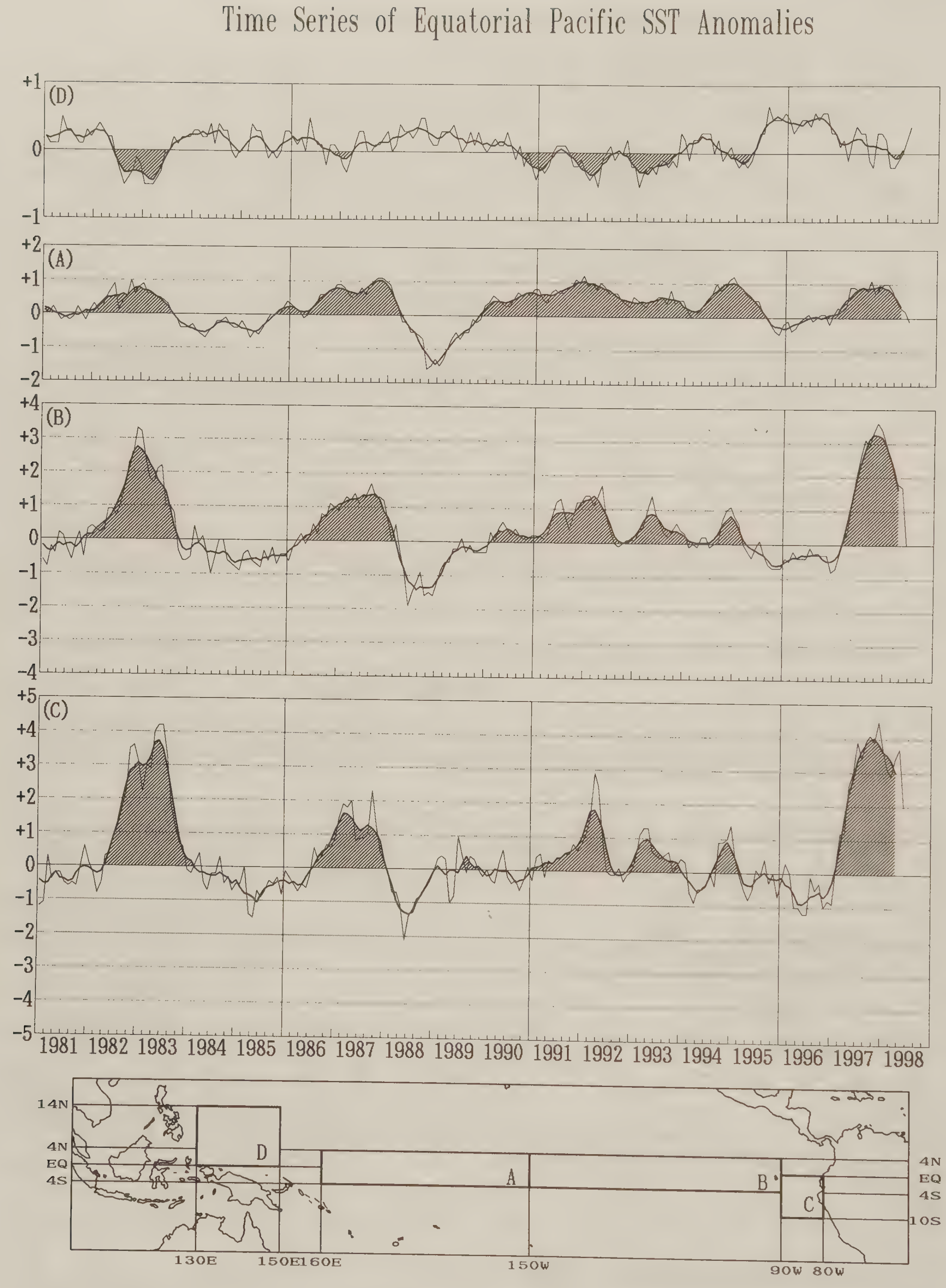
Fig.22 Monthly sea level anomalies for MAY 1998 obtained from mean sea level (1975-1995) adjusted for atmospheric pressure. This figure is prepared by the SOC of ISLP-PAC, Dept. of Oceanography, Univ. of Hawaii.



第23図 海域平均海面水温偏差の長期変動

Fig.23 Long-term variations of monthly mean sea surface temperature anomalies (°C) for the areas shown in the right panel. Anomalies are computed from the JMA climatology (1961-90). Thin lines show the monthly mean and thick lines their 13-month running means.





第24図　太平洋赤道域の海面水温偏差時系列図

Fig.24 Time series of monthly mean SST anomalies (°C) in the equatorial Pacific Ocean for the areas indicated at the bottom panel.
Thin lines show the monthly means and thick lines their 5-month running means. Positive anomalies (A, B, C) and negative anomalies (D) are shaded. Anomalies are computed from the JMA climatology (1961-1990).

MONTH	SEA SURFACE TEMPERATURE AND ANOMALY (°C) REGION D 14N-EQ 130E-150E		REGION A 4N-4S 160E-150W		REGION B 4N-4S 150W-90W		REGION C EQ-10S 90W-80W		SOI	SEA LEVEL PRESSURE ANOMALY (hPa) TAHITI 17-33S 149-37W	DARWIN 12-24S 130-52E
JAN 96	29.0	0.5	27.9	-0.1	25.0	-0.4	24.1	-0.2	0.8	1.0	-0.7
FEB 96	28.6	0.3	27.6	-0.4	25.7	-0.5	26.0	0.3	0.1	-0.2	-0.5
MAR 96	28.8	0.4	27.8	-0.3	26.7	-0.2	25.9	0.0	0.7	1.0	-0.3
APR 96	29.3	0.5	28.1	-0.1	26.7	-0.4	24.1	-1.0	0.8	0.5	-0.5
MAY 96	29.6	0.5	28.5	0.0	26.2	-0.4	22.9	-1.0	0.3	1.2	1.2
JUN 96	29.7	0.4	28.6	0.1	25.7	-0.4	21.5	-1.2	1.4	1.6	-0.2
JUL 96	29.8	0.6	28.4	-0.1	25.1	-0.1	20.4	-1.2	0.7	0.6	-0.6
AUG 96	29.6	0.5	28.4	0.0	24.3	-0.3	20.5	-0.1	0.4	0.4	-0.3
SEP 96	29.8	0.6	28.4	0.1	24.3	-0.3	19.8	-0.5	0.5	-0.7	-1.7
OCT 96	29.9	0.6	28.5	0.1	24.3	-0.3	20.4	-0.3	0.4	-0.1	-0.8
NOV 96	29.5	0.3	28.2	-0.2	24.3	-0.3	20.5	-1.0	-0.0	-0.5	-0.5
DEC 96	29.2	0.3	28.3	0.1	24.1	-0.8	21.8	-0.8	0.8	-0.3	-1.9
JAN 97	28.6	0.1	28.3	0.3	24.7	-0.7	23.4	-0.9	0.3	1.7	0.9
FEB 97	28.5	0.2	28.2	0.2	25.9	-0.3	25.9	0.2	1.2	1.0	-1.9
MAR 97	28.3	-0.1	28.4	0.3	27.0	0.1	27.1	1.2	-0.6	-0.5	0.9
APR 97	29.0	0.2	29.1	0.9	27.5	0.4	26.3	1.2	-1.1	0.4	2.3
MAY 97	29.5	0.4	29.4	0.9	27.9	1.3	26.5	2.6	-2.5	-2.1	0.9
JUN 97	29.6	0.3	29.3	0.8	28.1	2.0	25.7	3.0	-2.3	-0.8	2.1
JUL 97	29.5	0.3	29.4	0.9	27.8	2.6	25.5	3.9	-0.8	-0.1	1.2
AUG 97	29.0	-0.1	29.2	0.8	27.7	3.1	24.0	3.4	-2.0	-0.9	2.2
SEP 97	29.0	-0.2	29.4	1.1	27.5	2.9	24.2	3.9	-1.4	0.1	2.7
OCT 97	29.6	0.3	29.1	0.7	27.9	3.3	24.8	4.1	-1.6	-0.2	2.7
NOV 97	29.5	0.3	29.3	0.9	28.2	3.6	25.4	3.9	-1.2	0.4	2.7
DEC 97	29.1	0.2	29.2	1.0	28.3	3.4	27.1	4.5	-0.9	-0.5	1.1
JAN 98	28.3	-0.2	29.0	1.0	28.4	3.0	28.0	3.7	-2.3	-3.6	1.4
FEB 98	28.1	-0.2	28.8	0.8	28.8	2.6	28.8	3.1	-1.8	-0.9	3.5
MAR 98	28.3	-0.1	28.6	0.5	29.0	2.1	28.8	2.9	-2.5	-2.8	2.3
APR 98	28.8	0.0	28.5	0.3	28.9	1.8	28.5	3.4	-2.3	-1.5	1.4
MAY 98	29.3	0.2	28.7	0.2	28.3	1.7	27.6	3.7	0.0	0.4	0.5
JUN 98	29.7	0.4	28.4	-0.1	26.1	0.0	24.7	2.0	1.1	0.9	-0.5

第1表　エルニーニョ監視指数

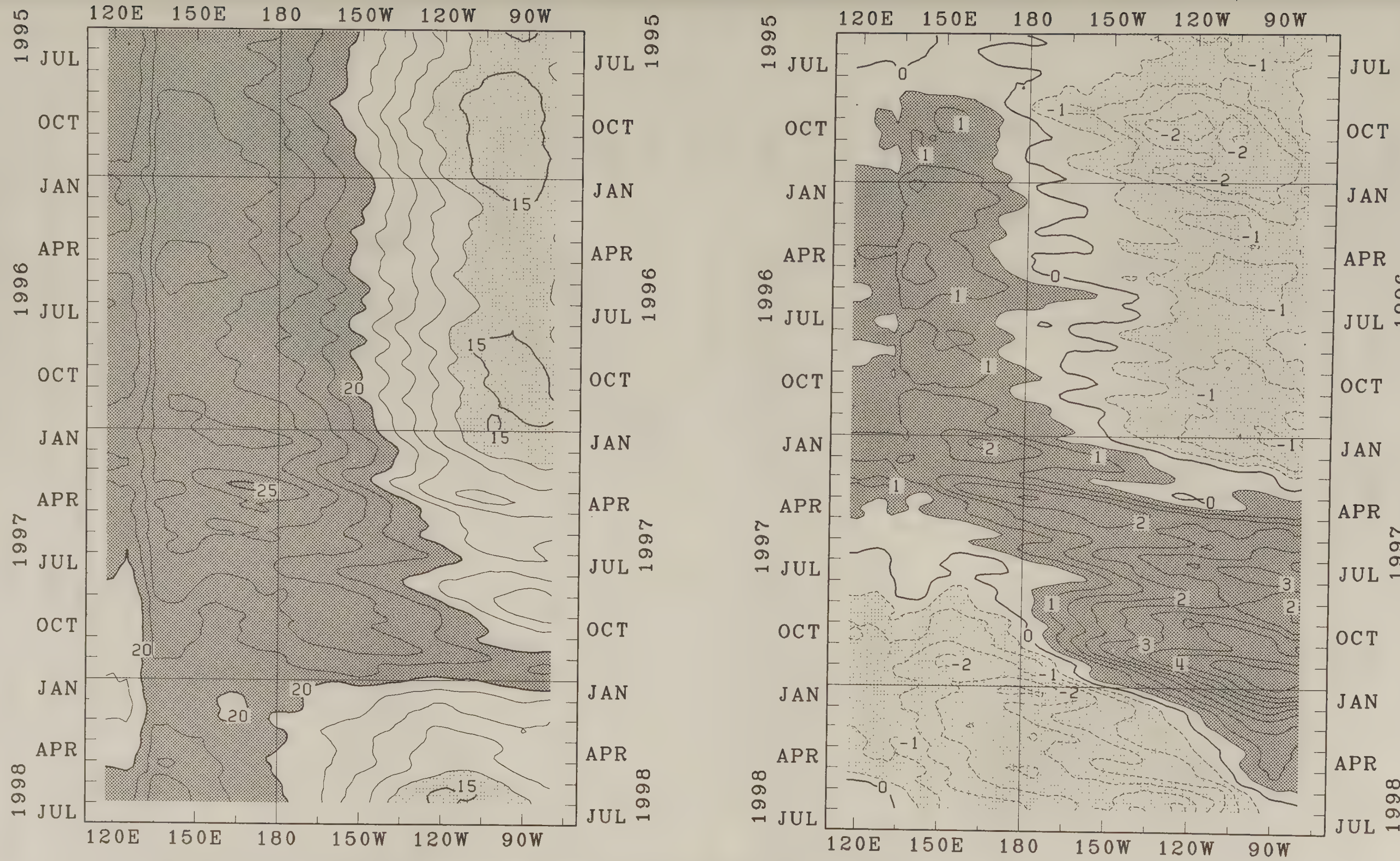
Table 1　El Nino Monitoring indices



第25図　赤道に沿った海面水温（左）および偏差（右）の時間-経度断面図

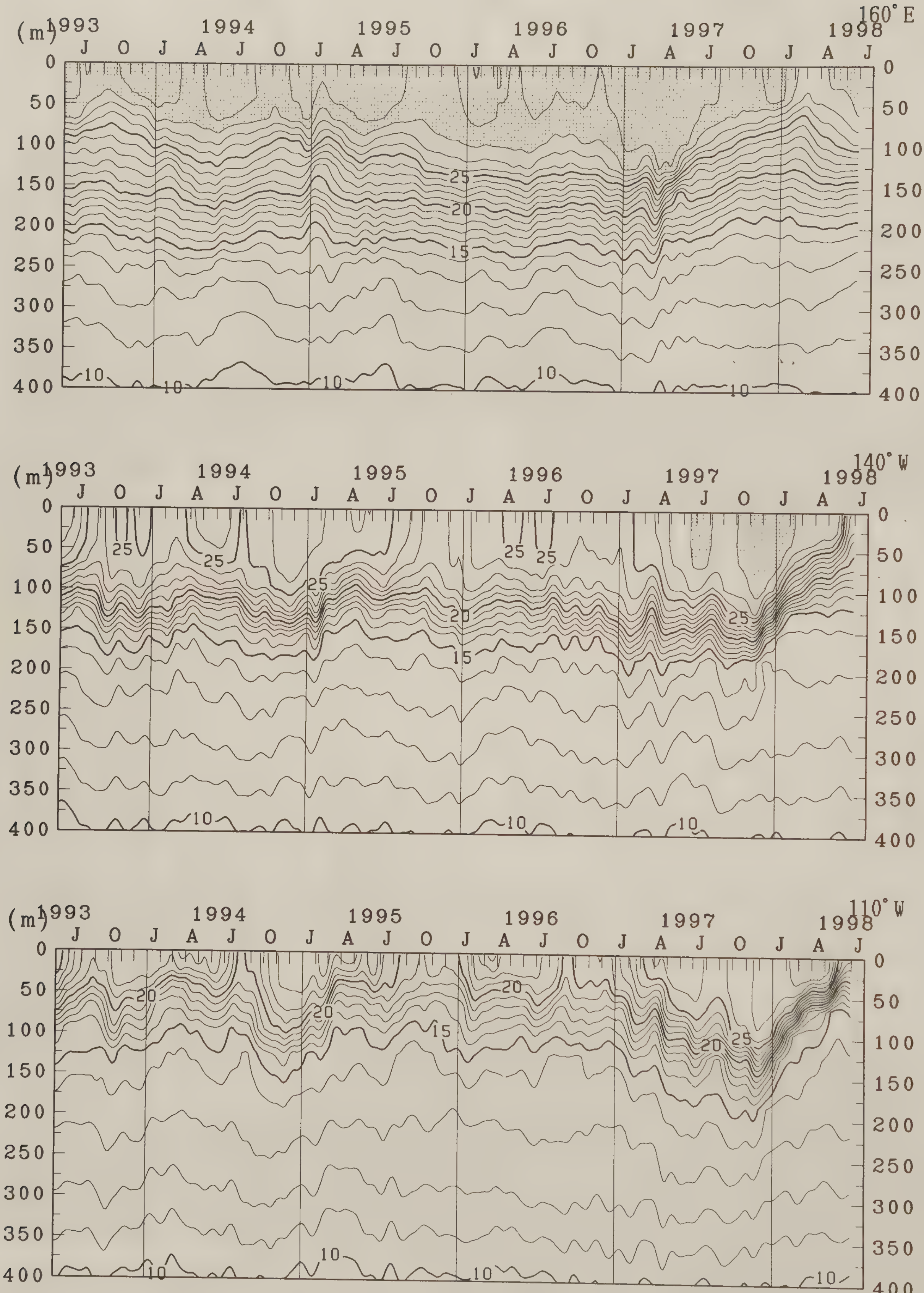
Fig.25　Time-longitude sections of SSTs (left) and anomalies (right) along the equator (2°N-2°S) in the global ocean. Contour interval is 1 °C (left) and 0.5 °C (right). Values greater than 28 °C are shaded and values less than 23 °C are spotted in the left panel. Dashed contours indicate negative anomalies in the right panel. Anomalies are computed from 1961-1990 base period means.

Time–Longitude Sections of Ocean Heat Content & Anomalies (Eq.)



第26図　太平洋の赤道に沿う海洋表層の貯熱量（左）及び偏差（右）の時間－経度断面図

Fig.26 Time-longitude sections of ocean heat content in the upper 260m along the equator (left) and anomalies (right) in the Pacific Ocean. Data are derived from the Ocean Data Assimilation System of JMA. Contour interval is 1°C (left) and 0.5°C (right). Values greater than 20°C are shaded and values less than 16°C are spotted in the left panel. Dashed contours indicate negative anomalies in the right panel. Anomalies are computed from 1987-1997 base period means.



第27図　太平洋赤道域の表層水温の時間－深度断面図

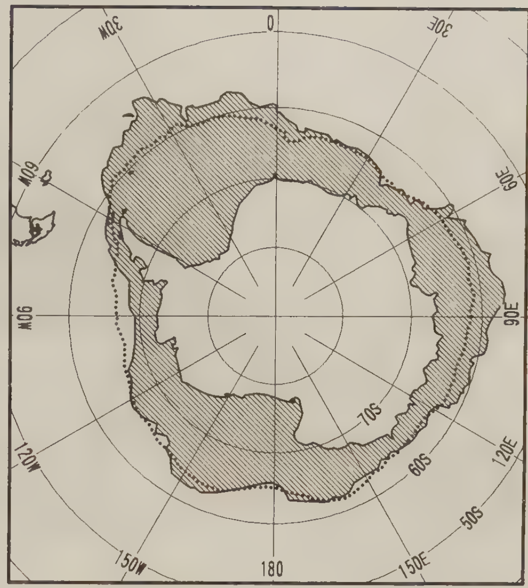
（上：西部、中：中部、下：東部）

Fig.27 Time-depth sections of equatorial subsurface temperature for the western Pacific (top, 160°E), the central Pacific (middle, 140°W) and the eastern Pacific (bottom, 110°W). Data are derived from the Ocean Data Assimilation System of JMA. Contour interval is 1°C. Values greater than 28°C are shaded.



第28-1図 北極域の海氷図（1998年 6月16日）

Fig.28-1 Sea ice chart in the Arctic on 16 June 1998.
The shaded area represents the sea ice extent. The dotted line denotes the mean ice edge averaged for the period from 1972 through 1990.
The data source is the National Ice Center (USA).



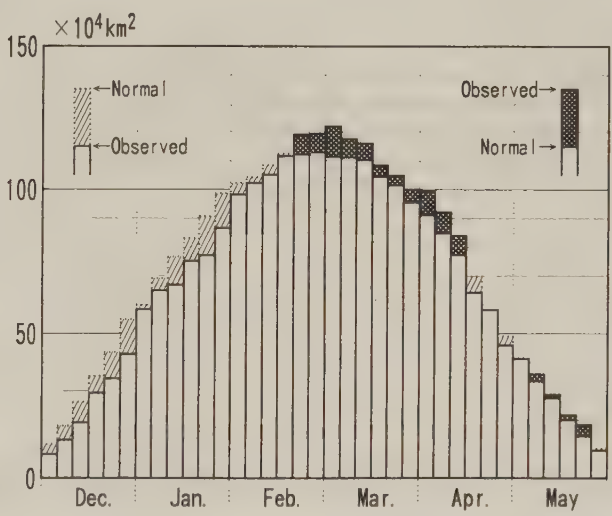
第28-2図 南極域の海氷図（1998年 6月17日）

Fig.28-2 Sea ice chart in the Antarctic on 17 June 1998.
The shaded area represents the sea ice extent. The dotted line denotes the mean ice edge averaged for the period from 1973 through 1990.
The data source is the National Ice Center (USA).



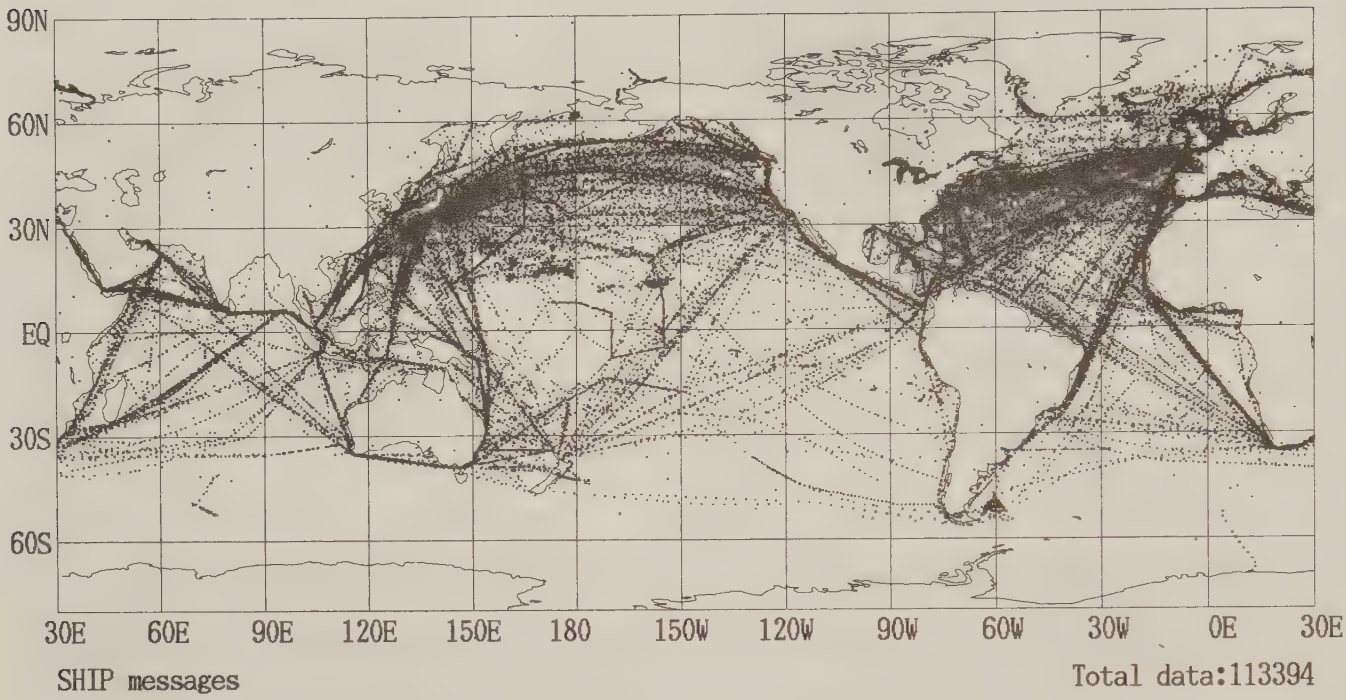
第28-3図 オホーツク海の海氷域面積が最大であった日の海氷分布図（1998年 3月 5日）

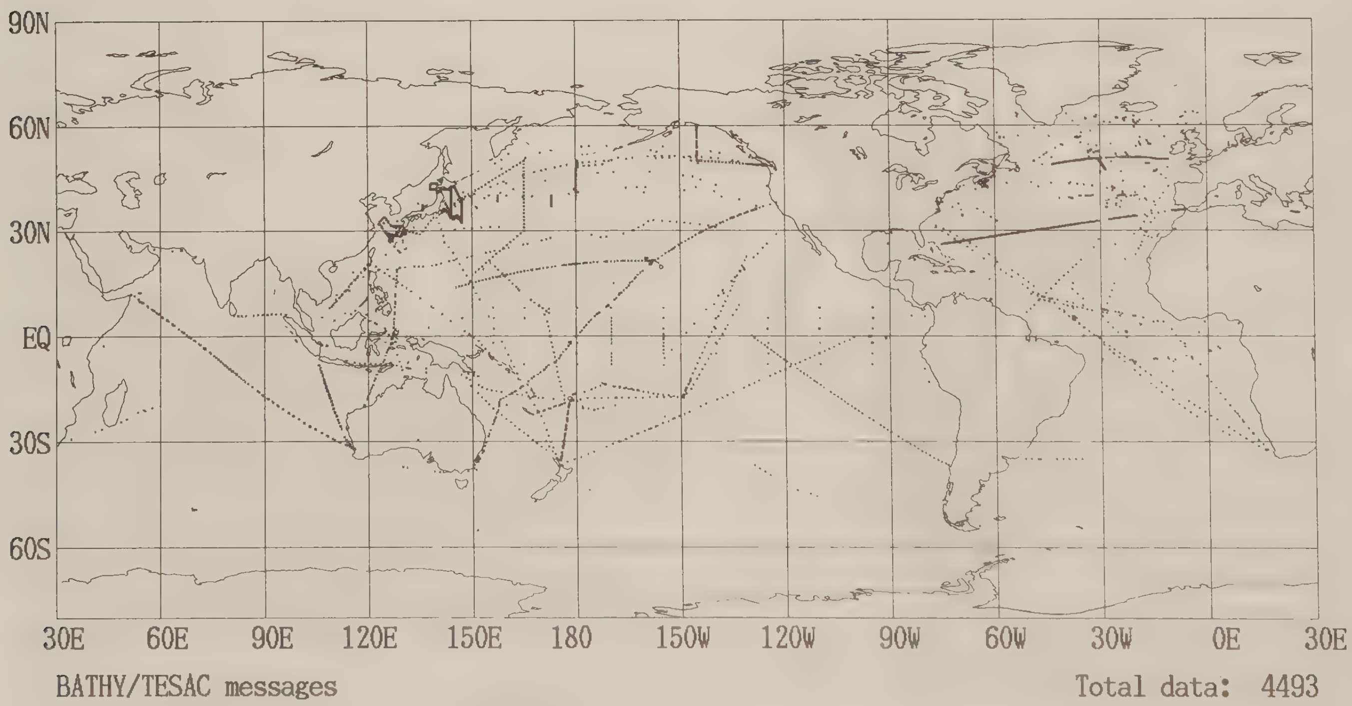
Fig.28-3 Sea ice chart in the Sea of Okhotsk on 5 Mar. 1998, when the largest sea ice extent was recorded in the season.
The dotted line denotes the mean ice edge averaged for the period from 1971 through 1990.



第28-4図 オホーツク海半旬海氷域面積（1997/98）

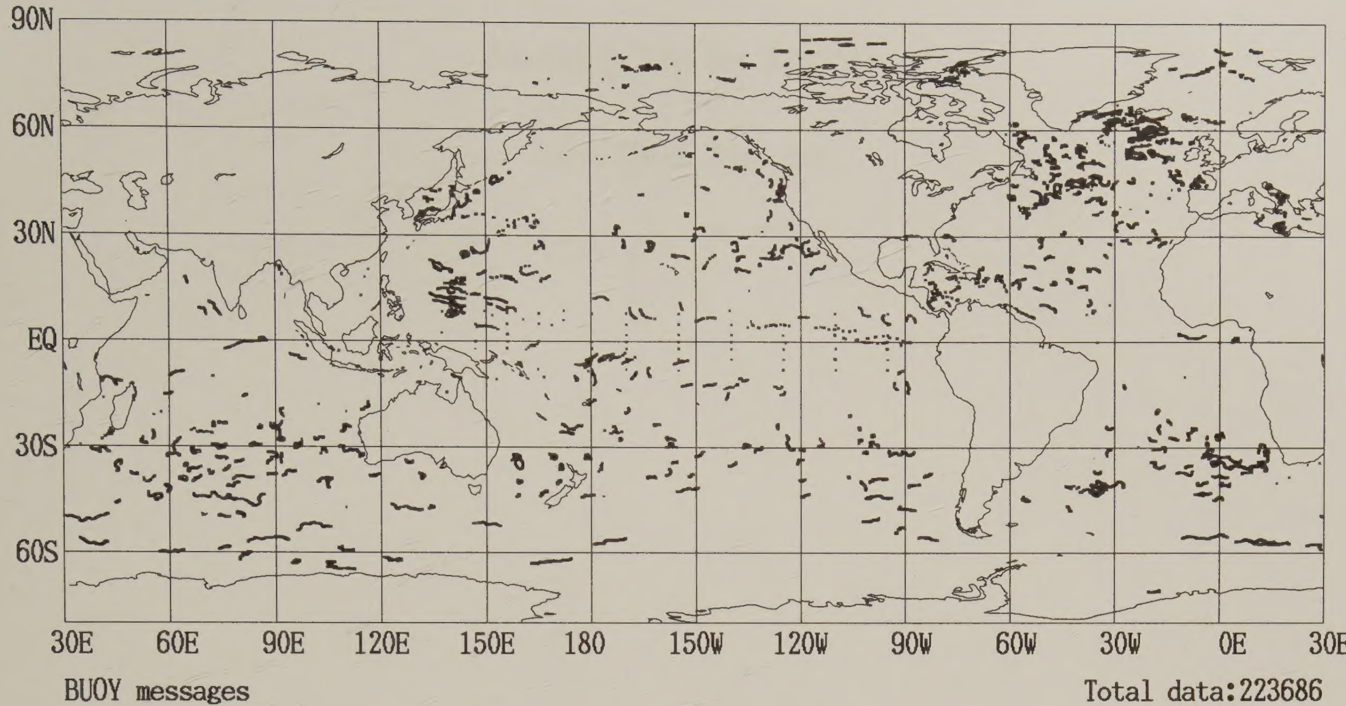
Fig.28-4 Time series of 5-day sea ice extent in the Sea of Okhotsk (1997/98)

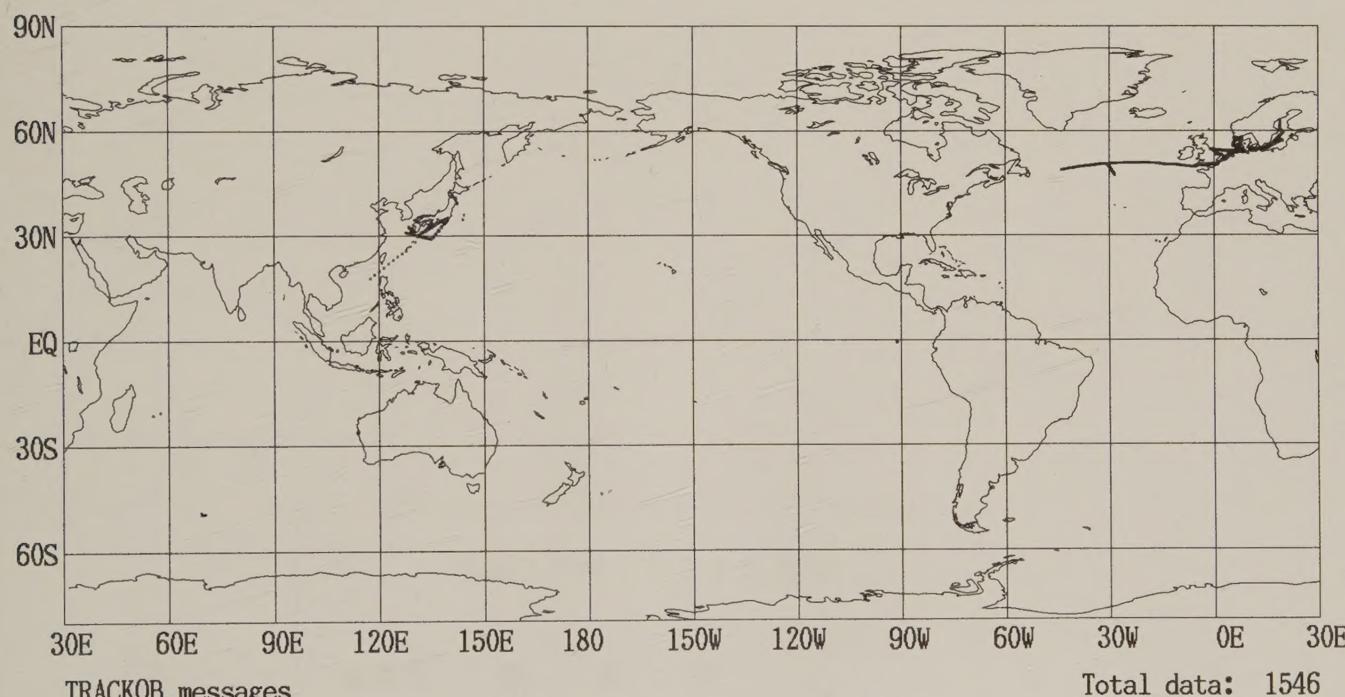




第29-1図　測点分布図(1998年 6月)

Fig.29-1 Geographical distribution of SHIP messages (SST data, top) and BATHY/TESAC messages (subsurface temperature data, bottom) for JUN 1998.





第29-2図　測点分布図(1998年 6月)

Fig.29-2 Geographical distribution of BUOY messages (buoy drift and SST data, top) and TRACKOB messages (ship drift and SST data, bottom) for JUN 1998.

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